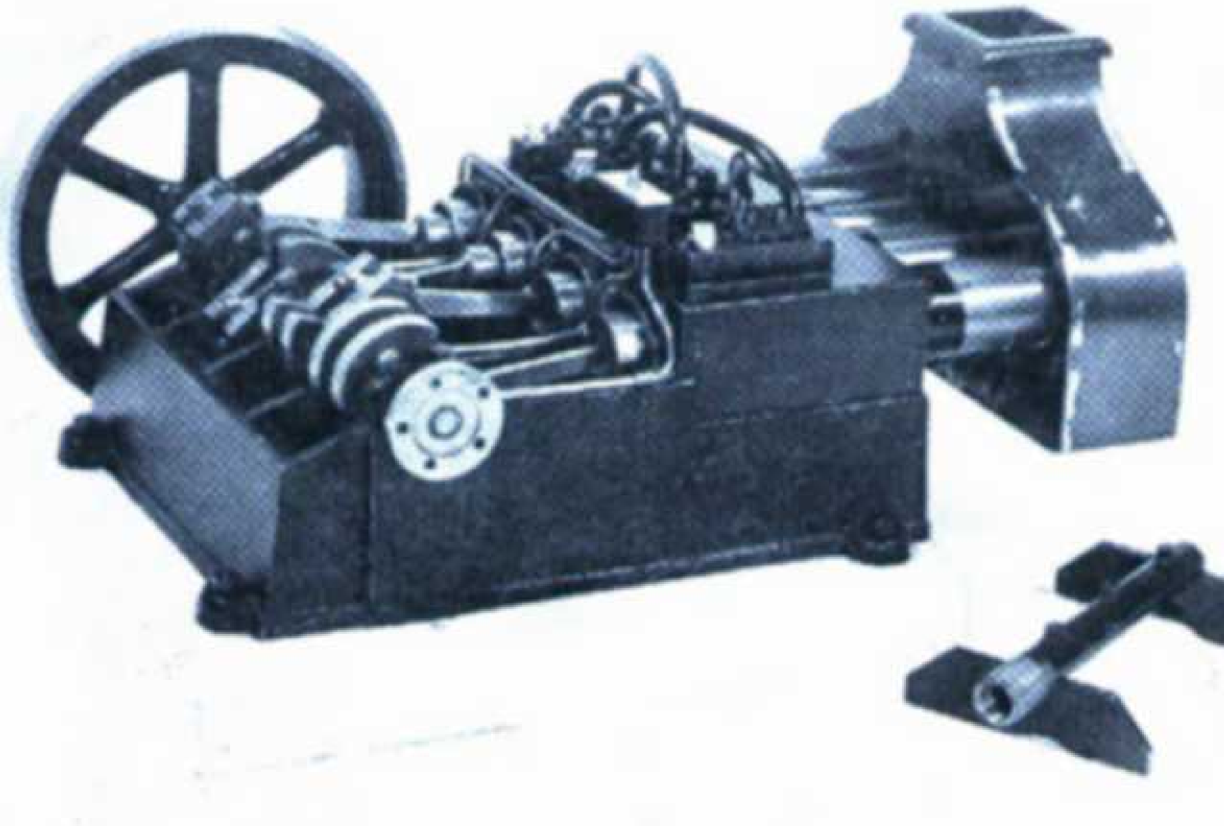
THE MODEL ENGINEER



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THE MODEL ENGINEER

EVERY THURSDAY

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Our Cover Picture

In an article on the subject of " Hot Air Engines," published in " The M.E." some time ago, we observed that despite the perennial interest in this type of engine expressed by readers, it apparently offered little attraction to the model constructor. We fully expected, and indeed hoped, that this statement would be regarded as a challenge by constructors of such engines who had hitherto kept their light under a bushel; and so it has proved, for information has since been received of one or two amateur-built hot-air engines of interesting design. One of these, built by Mr. A. E. Phillips, forms the subject of this week's cover picture, and is described in an article elsewhere in this issue. It is a type of design which we feel sure will please many enthusiasts, as although it is a multi-cylinder engine, its working parts are by no means complicated; by placing the power and displacers in tandem, the layout is simplified, and the rods and links which often make even single-cylinder hot air engines look fearsomely complicated are eliminated.

SMOKE RINGS

Manchester Model Railway Exhibition

THIS YEAR's annual exhibition of The Manchester Model Railway Society will again be held at The Corn Exchange, Hanging Ditch, Corporation Street, Manchester, opening at 12.00 noon on Friday, December 18th and at 10.00 a.m. on Saturday and Sunday, December 19th and 20th. Closing times are 9.00 p.m. on the first two days and 7.00 p.m. on the Sunday, December 20th.

The exhibits will be a blend of the old-established favourites and new stand arrangements for the historical and stationary models. Models for competition will be grouped together. Working layouts and exhibits will again be there in force and amongst these the society's " O " gauge running track will be the centre-piece. A considerable amount of work has been done by members on this track since its last public appearance. The locomotive yard has been completely relaid and is now fitted with its own control panel so that it can be worked, if required, as a separate entity. The goods yard has been moved from the inside of the running track to the outside so that spectators can have a far better view of the remotely controlled shunting operations.

The " EM " gauge track will consist of a layout giving an end-to-end run of nearly 90 ft. with a terminal station at each end and two intermediate stations.

The 2½-in. gauge tram track is to make a welcome reappearance and new cars are expected to be in service for the edification of the body of tramway enthusiasts which grows year by year.

Most of the other major model railway organisations will be contributing stands displaying the pick of their members' work, and the Stephenson Locomotive Society and the Talyllyn Railway Preservation Society will also be represented.

The Churchward " Saints "

THE RECENT withdrawal of British Railways Western Region engine No. 2920, *Saint David*, means that the famous class to which this engine belonged has become extinct. At the moment of writing, there seems to be some reluctance to break up the engine, because of a widely-expressed desire that she should be preserved, and we can only hope that the British Transport Commission will decide to keep the engine as a memento of an epoch-making design.

The " Saint " class, latterly, consisted of all the 2-cylinder 4-6-0 type express passenger engines with 6 ft. 8½ in. coupled wheels and 18½ in. by 30 in. cylinders, and officially designated the " 29XX " class. The type originated with engine No. 100 (later, 2900, *William Dean*) in 1902, at the end of Mr. Dean's superintendency, though there is little doubt that G. J. Churchward was responsible for the basic design. This was followed by No. 98, a purely Churchward engine embodying a number of detail alterations. Then came a further twenty, all alike except that thirteen of them had the 4-4-2 wheel arrangement. In 1905 another ten 4-6-0s were built, the " Ladies," which were followed by ten " Saints " in 1906 and twenty-five " Courts " in 1907-8. The last-named were, in fact, the final stage of development of this particular type, and from 1910 onwards, all the earlier engines were brought into line with the " Courts," to make one class of seventy-seven thoroughly efficient, powerful and speedy express passenger engines which have left an indelible mark in the annals of locomotive design. It is probably not going too far to state that, of their type, they had no equals anywhere; certainly none was better.

L.B.S.C.'s "Britannia" in 3½ in. Gauge

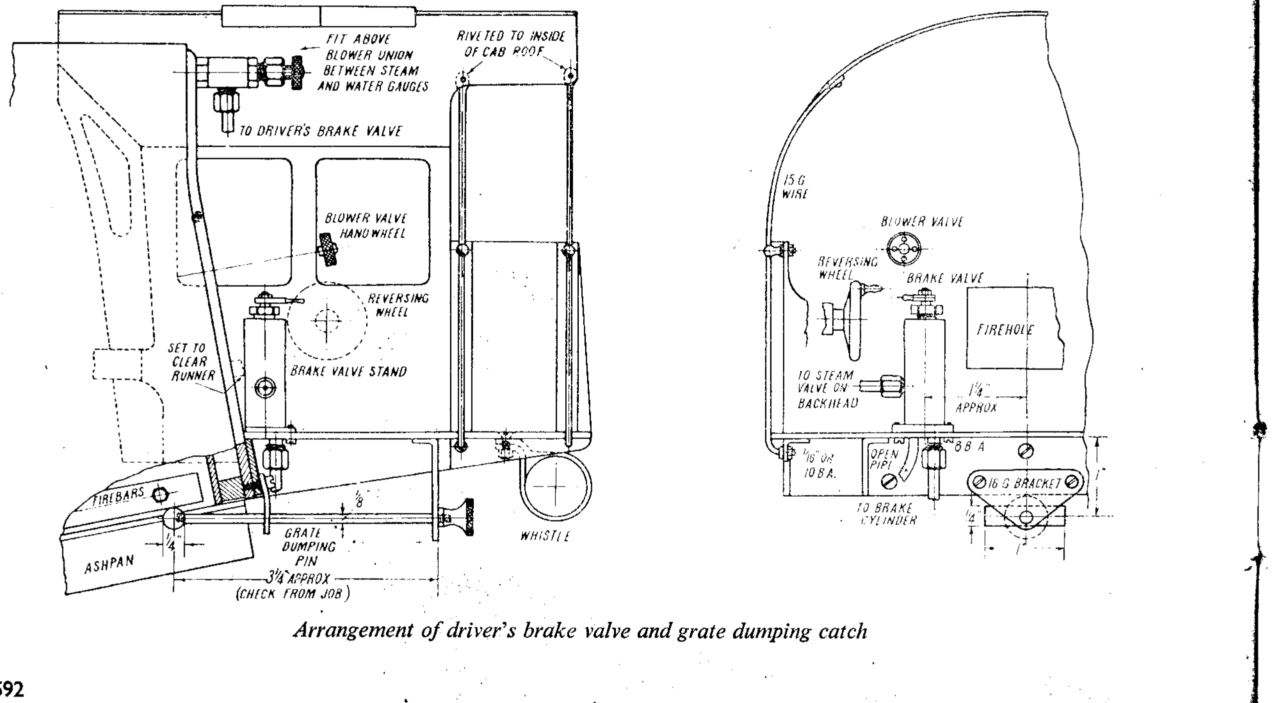
● CONCLUDING INSTALMENT

ON the full-sized engine, the vacuum-brake valve is mounted on a square pedestal, and the steam-brake valve on the backhead above it. As we haven't any vacuum brake, we might as well utilise the pedestal for the steam-brake valve, and thus keep something like full-size appearance. The drawings show how this can easily be done, the valve being made after the fashion of my disc-in-a-tube regulators. The body can be made from a casting, or from a bit of $\frac{1}{2}$-in. square brass rod $1\frac{1}{4}$ in. long. Chuck truly in the four-jaw, face, centre, and drill through with $\frac{7}{16}$-in. drill; reverse in chuck, and face the other end to bring the length to $1\frac{3}{16}$ in. The top cover is made from the same size of rod; chuck truly in four-jaw, face off, and turn $\frac{1}{4}$ in. length to a tight fit in the hole in the column. Part off at $\frac{5}{16}$ in. from the end. Reverse and re-chuck in the three-jaw; face, centre, put a No. 30 drill through, open out to a bare $\frac{1}{4}$ in. depth with 7/32-in. drill, and tap $\frac{1}{4}$ in. × 40. Drill No. 51 holes in each corner, and countersink them. Make a gland to suit, from $\frac{3}{8}$-in. round or hexagon rod.

The base can be made either from a casting, or from $\frac{3}{4}$-in. square rod. Chuck truly in four-jaw, and face the end; turn 5/32 in. length to a tight fit in the column, and part off a full $\frac{1}{4}$ in. from the end. Reverse and rechuck in the three-jaw, and face off the bottom end truly; then file or mill off $\frac{1}{8}$ in. of one side of the square flange, to allow the pedestal to fit up close against the backhead, (see view showing the cab.) On the underside, at 5/32 in. from the centre-line of the boss, make two centre-pops, $\frac{1}{4}$ in. apart; drill one $\frac{1}{8}$ in. and the other 5/32 in. for a full $\frac{1}{16}$ in. depth, as shown. When looking straight down on the port-face, the larger one should be to your right. On the top of the boss, which forms the portface, mark out and drill the two No. 48 holes as shown, running them into the two blind holes under the flange, (see section.) Drill four No. 51 holes close to the boss, corresponding to those in the upper fitting, and countersink them on the underside; drill four more in the flange, for attaching the pedestal to the footplate.

In the larger hole under the base, fit a $\frac{1}{4}$-in. × 40 union nipple as shown, and in the smaller hole, about 2 in. of $\frac{1}{8}$-in. pipe, silver-soldering the joints; at $\frac{3}{4}$ in. from the top of the column, drill a 5/32 in. hole, and silver-solder a 7/32-in. × 40 union nipple into it, same as those on the lubricator.

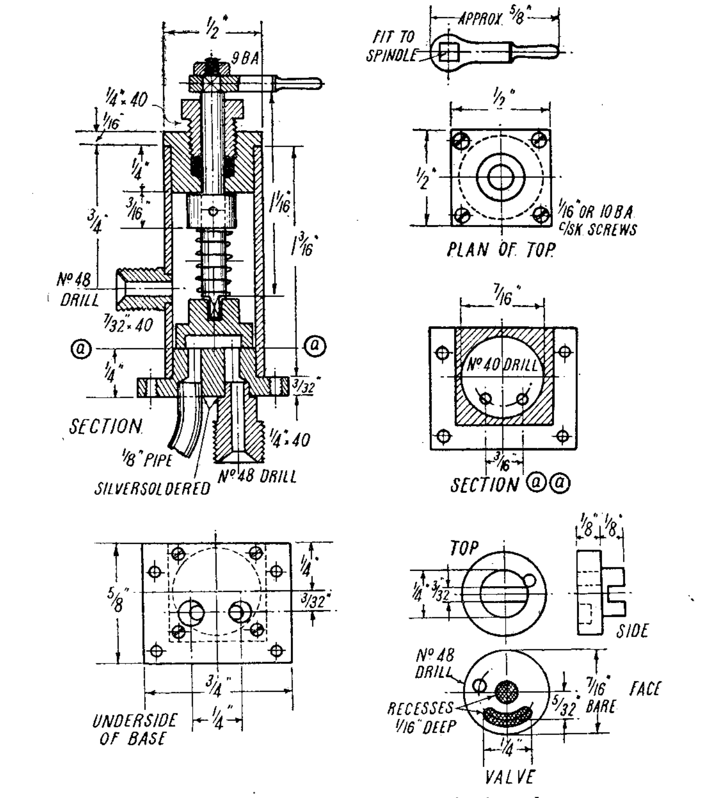
The valve is made from $\frac{7}{16}$-in. round bronze rod. Chuck in three-jaw, face the end, and turn $\frac{1}{8}$ in. length to $\frac{1}{4}$ in. diameter. Turn the next $\frac{3}{16}$ in. to an easy fit in the column, and part off at a full $\frac{1}{8}$ in. from the shoulder. Reverse in chuck and face the flange truly, making a recess in the middle about $\frac{1}{16}$ in. deep, with a $\frac{1}{8}$-in. drill. Make two centre-pops in the face, to correspond with the ports, and drill in about $\frac{1}{16}$ in. depth with No. 48 drill, connecting the depressions by a curved slot which can be chipped by aid of a small chisel. Drill another No. 48 hole, as shown, for steam admission to brake pipe



Arrangement of driver's brake valve and grate dumping catch

union. File or mill a 3/32 in. slot in the boss, and face the contact side truly.

The spindle is a piece of $\frac{1}{8}$-in. bronze or rustless steel rod, a full $1\frac{3}{8}$ in. long. One end is filed flat for $\frac{1}{8}$ in. length, to fit easily in the slot in the valve boss. The other end is squared, and screwed, as shown, to take the handle, which is made from 3/32-in. $\times$ $\frac{3}{16}$-in. mild steel, to shape shown in the detail sketch. Drill the hole in the end 3/32 in. and file it square; then file the square on the spindle to fit it. The collar is a slice of $\frac{1}{4}$ in. round brass rod, $\frac{3}{16}$ in. thick, with a No. 32 hole drilled through it.



Section and details of driver's brake valve

Assembly and Erection

True up the valve and portface in the same way that I describe for valves and faces in cylinders, then press the port boss into the column, with a smear of plumbers' jointing around it. Secure it with four $\frac{1}{16}$-in. or 10-B.A. countersunk screws, same as a cylinder cover. Put a spot of cylinder oil on the valve face, and drop it on to the seating. Push the collar on to the spindle, so that the bottom of it is about $\frac{3}{8}$ in. above the tongued end; put the tongue in the slot in the valve boss, and press the top cover home. The spindle should have just the weeniest bit of endplay; if tight, remove cap, and press the collar down a shade. If loose, the collar is too low, so push it up. When O.K. pin the collar to the spindle with a piece of brass wire; bits of brass blanket pins come in just right for jobs like this, those I use being a drive fit in a hole drilled with a No. 56 drill. Replace the spindle with a light brass spring under the collar, as shown; the cap can then be pushed home with a smear of plumbers' jointing around it, and secured by four $\frac{1}{16}$-in. or 10-B.A. screws, like a cylinder cover, (see plan). There is plenty of room for the screws in the corners of the pedestal. The gland can be packed with a few strands of graphited yarn.

Turn the spindle slowly in a clockwise direction until, when air is blown in at the side union, it issues freely from the union nipple underneath the stand; this will be the "brake on" position, so put the handle on the square, pointing a little towards the left. Looking down on it, it should indicate "8 o'clock." Secure it with a commercial nut. If it is moved to the right, to about the "4 o'clock" position, the hole in the valve will leave the steam port, cutting off steam to the brake cylinder, and the cavity in the valve face will bridge both the ports, allowing steam to escape from the brake cylinder to the atmosphere, via the cavity, exhaust port, and open pipe.

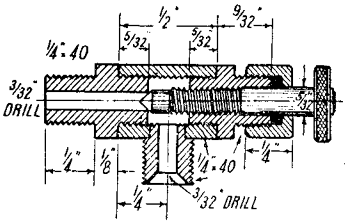
The location of the pedestal is shown in the illustration, being $1\frac{1}{4}$ in., from centre-line, and close to the backhead. Drill a $\frac{1}{4}$ in. hole at this place, through the footplate, and slot it with a round file, enough to allow the union nipple and pipe to be put through. Set the pedestal in position, and put a No. 51 drill through the holes in the square flange, right through the footplate. Remove pedestal, tap the holes in the flange 8 B.A., open those in the footplate with a No. 43 drill, replace pedestal, and secure with four 8-B.A. screws put through from underneath as shown.

Isolating Valve

The driver's valve is supplied with steam from the boiler through an isolating valve on the backhead. To make it, part off a full $\frac{1}{2}$ in. length of $\frac{3}{8}$-in. round brass rod. Chuck in three-jaw, centre, put a 7/32 in. drill right through, and tap $\frac{1}{4}$ in. $\times$ 40; take a truing-up skim off both ends. Drill a 5/32 in. hole in the middle, and in it, silversolder a $\frac{1}{4}$-in. $\times$ 40 union nipple. Chuck a piece of $\frac{5}{16}$-in. hexagon brass rod in three-jaw; face, centre, drill to $\frac{5}{8}$ in. depth with 3/32 in. or No. 42 drill, turn down $\frac{1}{4}$ in. length to $\frac{1}{4}$ in. diameter, and screw $\frac{1}{4}$ in. $\times$ 40. Part off at $\frac{9}{16}$ in. from the end. Rechuck in a tapped bush held in three-jaw; turn down $\frac{3}{16}$ in. of the end to $\frac{1}{4}$ in. diameter, screw $\frac{1}{4}$ in. $\times$ 40, and face off 1/32 in. to get a true surface for the valve seating. Screw this end into the body. Part off a $\frac{7}{16}$ in. length of $\frac{5}{16}$-in. hexagon rod, chuck in three-jaw, centre, drill through with No. 30 drill, open out to $\frac{1}{8}$ in. depth with No. 21 drill, and tap the rest 5/32 in. $\times$ 32 or 40. Turn down $\frac{3}{16}$ in. length to $\frac{1}{4}$ in. diameter and screw $\frac{1}{4}$ in. $\times$ 40. Rechuck in a tapped bush, and turn down the other end for 5/32 in. length to $\frac{1}{4}$ in. diameter, and screw $\frac{1}{4}$ in. $\times$ 40. Assemble as shown, with a taste of plumbers' jointing on the threads, and fit a screwed pin,

with hand wheel and gland nut, same as I have described umpteen times for other valves.

Drill a 7/32 in. hole in the backhead, as near to the top as possible, over the blower elbow, and between the steam and water gauges. Tap $\frac{1}{4}$ in. × 40, and screw the fitting



Brake isolating valve

home. Connect the union on it, to the union on the side of the brake-valve pedestal, with a thin-walled $\frac{1}{8}$-in. pipe running as close to the backhead as possible. The union underneath the pedestal is connected to the union on the steam-brake cylinder, by a similar pipe running around the side of the ashpan, also as close as possible. If these pipes are kept hot, condensation in the brake cylinder will be reduced to a minimum. The little drain cock on the brake cylinder can be operated by a Bowden wire in a tube, same as the cylinder cocks, the tube keeping the steam pipe company, back to the footplate. A similar small lever can be attached to the side of the cab, and connected to the back end of the Bowden wire, same as the cylinder cock gadget; no special drawings should be needed for a simple job like that!

Dumping Catch

After cavorting about with sundry ideas for a catch to retain the centre part of the grate in position, yet allowing of easy dumping after a run, I haven't found anything to beat the simple push-pin for ease of construction and erection. The whole doings is shown in the illustration. The pin is a $3\frac{3}{8}$ in. length of $\frac{1}{8}$-in. round steel, with a knob on one end, and a 1 in. length of $\frac{1}{4}$-in. round steel screwed on to the other. A small triangular bracket is cut from 16-gauge steel, and attached to the bottom of the backhead by two of the screws holding the cab bracket in place, (see end view). The other end passes through a No. 21 hole drilled in the apron. After fitting the bracket and drilling the hole in the apron, screw the knob on the spindle, poke the latter through the holes, and screw it into the T-head whilst holding it against the triangular bracket. Pulling the knob, releases the grate; after clearing the ashpan, replace grate with rake or pricker, and push the knob home. It would be quite possible to fix up a bell-cranked wire, with a lever, to lift the grate back into position again, but it isn't worth the trouble; I fitted a "mousetrap" catch on *Tugboat Annie*, but I never use it.

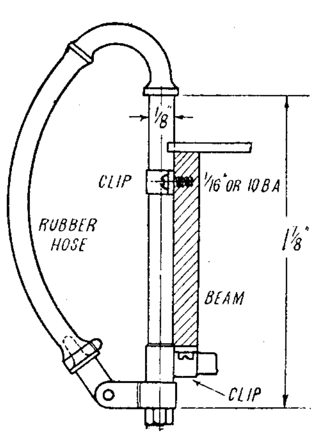
Handrails

The handrails can be made from German silver, rustless steel, or plated spoke wire, about 15-gauge. Those on the smokeplates and the boiler, need no separate illustrations, as they can easily be fitted by using the general arrangement drawing as a guide. The knobs can be screwed direct into the boiler shell, with plumbers' jointing on the threads; on the smoke plates, they can be nutted on the inside of the plates. The cab handrails are shown here. They can be flattened at the top, and riveted to the cab roof by $\frac{1}{16}$-in. rivets. Halfway down, they are supported by knobs at the top of the door frame, whilst at the bottom, they are bent to curve inwards, and pass through holes drilled in the outer cab brackets. The ends should be reduced slightly, screwed $\frac{1}{16}$ in. or 10 B.A., and fixed with commercial nuts, washers being placed between the shoulder, and the bracket, as shown. Plated handrail knobs are sold commercially, and they are really not worth the trouble of making; but if anybody wants to make their own, I described the method in the *Tich* serial. An outline of the knob is filed in the end of a piece of flat steel (an old worn-out flat file will do very well) and used as a form tool, cutting the knobs to the profile required, at one fell swoop. The holes for the handrails are drilled in a simple jig, merely a piece of square steel with a shallow hole in the end, to take the ball end of the knob, and a cross-hole to guide the drill through the middle of it.

Chime Whistle

This darned whistle business has given your humble servant the proverbial pain in the neck! The chime whistle that I specified for *Pamela* worked fine, and when the two separate tubes were in proper harmony, the sound was pleasing, so I thought I'd enlarge the idea into three separate tubes. Alas—I soon found that unless all three tubes took the same amount of steam, each one gave a different volume of sound; and although the notes harmonised, the result sounded like three kids of different ages trying to sing carols on the doorstep. After some jerrywangling, I got the notes O.K. both for sound and volume; and then was stumped for some place to put the "Pipes of Pan" where they could blow unobstructed. I tried alongside the ashpan, with the tubes separated, so as to keep hot, and give clear notes, but had no luck. However, to cut the tale to Manx-cat length, I bowed to the inevitable, and made a small copy of the "Tritone" whistle, as fitted to the full-sized engines. This can be hung up under the "balcony" and will do the needful; but take it from Curly, you'll have to be jolly careful how you make it!

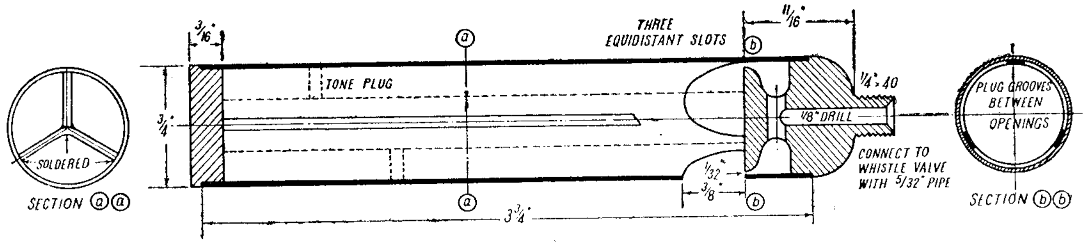
The barrel needs a $3\frac{3}{4}$ in. length of $\frac{3}{4}$-in. thin brass tube, with three semi-circular slots filed in it (or out of it, as you prefer) equidistant from each other, about $\frac{7}{16}$ in. from the end. Both ends must be squared off in the lathe. The barrel is divided into three chambers or compartments, by two strips of brass, about 20-gauge, one of which is bent in the middle to an angle of 120 deg., the other being half the width, and flat. They extend right to the bottom of the sound slots, and can be soldered by putting some liquid flux inside, with a few beads of



Vacuum-brake pipe

solder, and holding over a Bunsen gas flame, or a spirit lamp. The joints must be perfectly sealed all the way down. The top plug is a simple turning job needing no description. The bottom fitting is turned to the shape shown, from $\frac{1}{2}$-in. brass rod held in the three-jaw. Face the end, and turn $\frac{7}{16}$ in.

length to a tight fit in the tube, then turn a full $\frac{1}{4}$ in. to the section shown, reducing the end to leave an annular groove about 1/32 in. wide, between it and the tube. Part off at a bare 1 in. from the end; reverse in chuck, holding by the reduced part, turn $\frac{1}{4}$ in. length to $\frac{1}{4}$ in. diameter, screw $\frac{1}{4}$ in. × 40, and round off the end as shown.



Section of three-note chime whistle

Centre deeply, and put a No. 30 drill in for about $\frac{3}{4}$ in. depth. The annular groove has to be divided into three equal parts, and the easiest way to do this, is to solder three little bits of 16-gauge brass to the fitting, close to the edge; then chuck it in a tapped bush held in three-jaw, and take a skim off the bits of brass with a round-nose tool, until the fitting will fit the tube very tightly, the bits of brass making contact with it. Cross-drill $\frac{1}{8}$ in. or No. 30 as shown, and press into the end of the whistle tube. It should butt up tightly against the ends of the partition plates, and the plugs in the annular groove should come between the sound openings. Solder the lot by the method described above; any leakage will give the whistle a dose of 'flu. It'll sound that way, anyhow.

To tune up, cut three bits of cork to slide in the three chambers. Put one at the end, and the others a little way down as shown. Rig up a pressure tank of some sort, with a cock and union for connecting to the whistle, and an adapter for a tyre pump. A stout tin can would do, the bigger the better. Pump about 30 lb. of air in, and open the cock. One chamber can be tuned up at a time, to harmonise with the full-length one, by plugging the other sound slot with a bit of rag or waste. Adjust position of the cork plug until you get one to sound the right note, then set the other; G, C, and E would give a pleasing chord. When the chime is O.K. take the distances from the sound slots to the corks, and mark them on the barrel; remove corks, and cut pieces of brass to suit. The easiest way to do this, is to turn the end of the $\frac{3}{4}$-in. brass rod to a tight fit in the barrel, part off a $\frac{1}{8}$ in. slice, then mark it into three, as shown in the section at (*a*) (*a*). Saw into three at the marks, and then very little titivation with a file, will make two of them fit the chambers where the corks were. The cap closes the third chamber.

Solder the lot, as first suggested. The whistle should now blow a chime which is a passable imitation of the voice of big sister.

The only place to hang the whistle, which will allow steam to escape freely and not "spoil the tune," is under the "balcony" as mentioned above. Fix it as shown, with a couple of clips made from $\frac{3}{16}$-in. strip brass, secured with 3/32-in. countersunk screws and nuts. The union nipple on the whistle is connected to its mate on the valve, by a 5/32-in. pipe furnished with union nuts and cones to match.

Brake Pipe

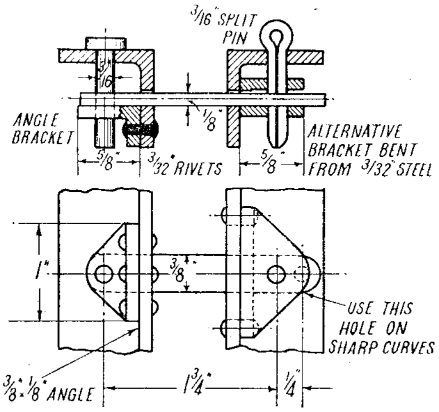
The dummy vacuum-brake pipe stands on both engine and tender, can be made from $\frac{1}{8}$-in. tube or wire. The beaded bend at the top, and the tee at the bottom, are available as castings; Mr. A. J. Reeves sent me some samples of "the real goods" some years ago, and still supplies them. They are exact copies of the tees, elbows, bends, unions and so on, used in the pipework of full-sized engines. The drip-cup at the bottom of the pipe, can be turned from $\frac{3}{16}$-in. hexagon brass rod and screwed on. The hose is made from $\frac{1}{8}$ in. rubber tube slipped over a pip screwed into the head at the top, and over a dolly or dummy coupling-plug at the bottom. This is turned from a bit of $\frac{3}{16}$-in. round brass rod, and is the same shape as a baby's soothing teat, flange and all; but instead of a ring, it has a flat tongue. A clip with extended wings, is fitted to the bottom of the tee, as shown, and the tongue of the dolly goes between the wings, a $\frac{1}{16}$-in. rivet passing through the lot. The complete stand is fixed to the buffer-beam, to the left of the coupling, by two thin brass clips about 5/32 in. wide, secured by $\frac{1}{16}$-in. or 10-B.A. screws; one clip is placed near the top, and the other underneath the edge of the beam. File a nick in the edge of the running-board, to allow the pipe to stand vertically against the beam.

Final Details

The coupling between engine and tender is a plain link made from $\frac{1}{8}$-in. × $\frac{3}{8}$-in. mild-steel, and passes through the slots in the drag beams. The engine end can be fixed by a headed pin, turned from $\frac{3}{8}$-in. round mild-steel, but it would be advisable to use an ordinary commercial split-pin for the tender end, as coupling-pins are frequently dropped when coupling up; if you drop a split-pin in long grass, it isn't worth wasting time looking for it, just fit another. The lower ends of the pins can either be supported by pieces of angle riveted to the beams below the slots, or proper channel-shaped brackets bent up from 16-gauge sheet steel, with slots cut in them, to coincide with the slots in the beams. They should be about $1\frac{1}{2}$ in. long, and riveted to the beams at the ends of the slots. The holes for the pins are drilled through the lot. The illustration shows the whole bag of tricks.

For lines with normal curves, a distance of $\frac{3}{4}$ in. between beams should suffice; but an extra hole can be drilled in the link, as shown, which will allow an extra $\frac{1}{4}$ in. between, for allowing extra freedom on sharp curves. Any discrepancy between the heights of the beams, can easily be disposed of, by bending the link to suit.

One thing I forgot to mention, was the method of operating the blowdown valve. In full size, a rod is attached to the valve lever, passing through a plain plate bracket with a hole in it, and coming out between the rear coupled wheel and the firebox wrapper, to which the bracket is riveted. The small



Engine and tender coupling

one can be operated in exactly the same way, using a bit of 3/32-in. wire for the rod. Bend the inner end into a small ring, for hooking through the hole in the valve lever. Make the bracket from a scrap of 16-gauge brass, and attach it to the wrapper by a small brass screw. The outer end of the wire can be bent into a small ring, just big enough to be held with your fingers. The valve should be closed when the ring is up against the bracket; pull to open.

Oddments such as dummy vacuum ejectors, lamp brackets, and the other blobs and gadgets adorning big sister's anatomy, can be "added to taste" as Mrs. Beeton might remark. Eh? No, I haven't a television set (time-wasters, I call them) so I don't know the party you are referring to! Personally, I've no use for useless excrescences (says Pat) as my engines are intended for WORK, and not for showing off in glass cases, nor even running on compressed air with their wheels off the rails. Well, that will be about the lot, as far as construction is concerned. As to operation, the engine is fired up, and driven on the road, in the same manner, as the other locomotives described in these notes; so I need not detail out all the rigmarole again.

As to painting; while making a real posh job of painting and lining isn't everybody's pigeon—my good friend Frank Cook of Leeds, could tell you a tale about that—quite a good finish can be obtained with "Valspar," one of the newer synthetics which resists heat, oil splashes, dirty water and so on. I've tried it, and find it all the makers claim, and I haven't any shares in the company, either. All you do, is to clean the engine thoroughly in petrol, or anything else that will remove all grease, and follow the directions on the tin. It can be thinned down, for lining with a drawing-pen, or a wheel. I have a wheel liner, sent by a friend in U.S.A. many moons ago. I believe they are now on sale in this country, though the price is pretty steep, compared to U.S.A. price.

Epilogue

Although the writing, drawing, and other "hard labour" which the serial on *Britannia* entailed, proved a real burden—and believe me, it was some job to adapt the design to make a successful 3½-in. gauger, and please Inspector Meticulous at the same time!—on the whole, it hasn't been an uncongenial job. "The best laid plans o' mice and men (I wonder why Rabbie Burrrrrrrrns didn't include women) gang aft agley," and I fully intended to build my own engine ahead of the notes, which would have saved much "drawing-board designing"; but Fate willed otherwise. How and why, doesn't concern these notes. Every bit of the engine needed scheming out to suit the gauge, and when I look at the huge pile of drawings, "all my own work" as the pavement artist would remark, I'm beginning to wonder how on earth I managed it. My thanks are due to Mr. Riddles for drawings of the full-sized engine, and for information as needed; both he and Mr. Cox were very helpful. Builders tell me they have had no trouble in following my detailed drawings, and some have added that in doing so, they didn't even need the notes, for which "testimonial" I bow very gratefully. Little *Britannias* are springing up all over the world; the first one to run on my own road was built by Mr. Buckle, of the Romford club, and a jolly fine show she put up, at that. She is a lovely job, nicely finished parts, bags of power, a free steamer, and the injector, made to "words and music," works perfectly every time.

Looking back, I don't think that I have overlooked or missed out anything important; but if any builder gets into difficulties, he has only to write to me, either direct or via the "M.E." offices, and I'll do my best to help. Should any points arise which might be of general interest, I'll deal with them in these notes, circumstances and our good friend the K.B.P. permitting; and to all *Britannia* builders, Curly sends out hearty good wishes for the reward that sweetens labour—the possession of a really smashing locomotive that will provide endless hours of pleasurable running.

CATALOGUES RECEIVED

The use of a magnifying lens of some kind is extremely helpful, and sometimes absolutely essential, in fine engineering and instrument work, and the quality of the lens employed may have a decisive influence on the accuracy of the work. Messrs. Gowllands Ltd., of Morland Road, Croydon, have sent us their latest catalogue of magnifiers for various purposes, including watchmaker's single and double-element eyeglasses, loupes, linen testers, binocular magnifiers, and lenses on adjustable or fixed-focus stands. These lenses are all highly corrected to give a wide and undistorted field of view, the actual degree of magnification, depending on the focal length, being arranged to suit the particular purpose for which they are designed. These magnifiers can be obtained from tool dealers and opticians, or direct from the manufacturers at the above address.

The latest edition of Garner's Buyer's Guide, which has been recently submitted to us by Messrs. T. Garner & Son Ltd., Primrose Hill, Barnsley, contains up-to-date information and prices of all kinds of tools and workshop equipment, including Myford, Boxford, Little John, Portass, and Coronet lathes and accessories, milling machines, shapers, bandsaws, drilling machines, also electrically-powered hand tools; also chucks, electric motors, welding outfits and gas-torches. All items can be obtained through the Garner Personal Hire Purchase plan, details of which can be obtained on application. The Buyer's Guide is supplied at a charge of 1s. per copy, post paid, this sum being subsequently refunded on any purchase made.

USING A TEST INDICATOR IN THE LATHE

By "Duplex"

THE dial test indicator is, perhaps, mainly used in the lathe for quickly setting work to run truly in the four-jaw chuck, but other applications include adjusting the inset cutters of boring bars to machine a bore to an exact diameter, and setting the machine vice on the vertical-slide to lie parallel with the surface of the lathe cross-slide.

The type of test indicator with the plunger projecting radially from the side seems to be in general use; but, as the following examples will probably show, the back-plunger pattern of this instrument may be found more useful in the small workshop. The standard, Starrett indicators are of the latter type, and this pattern is also manufactured by Messrs. Mercer of St. Albans.

Setting the Machine Vice

A test indicator with back-plunger is shown in Fig. 1 arranged for setting the fixed jaw of the machine vice parallel with the cross-slide, as is necessary when end-milling a keyway in a shaft. After the lathe mandrel has been locked, the shank of the indicator is gripped in the chuck so that the instrument lies horizontally. Incidentally, an anvil with a curved contact surface should be fitted to the plunger when aligning flat surfaces. Next, the vice is moved upwards by means of the slide feed-screw until the indicator needle has made a half turn, or so, and the cross-slide is then fed backwards and forwards in order to traverse the vice jaw across the indicator.

It is now only necessary to swivel the vertical-slide, or to adjust the position of the vice, until the indicator needle remains stationary throughout the traversing movement.

Adjusting a Tool-bit in a Boring Bar

Where a bore in a work-piece has been machined nearly to the finished size, for example when fitting the outer race of a ball-bearing, it is important to make sure of taking a finishing cut that will give accurate sizing. The tool-bit can be set radially outwards for an exact amount by means of the test indicator, mounted in the way represented in Fig. 2. Here, the indicator is carried on the pillar of the surface gauge, and the register pegs in the base of the gauge are brought into contact with the front shear of the lathe bed, in order to provide a constant location.

If the lathe mandrel is now turned by hand, a reading will be obtained as the point of the tool passes over the flat-faced anvil; the tool can then be adjusted to project for the additional number of thousandths-of-an-inch needed to finish the bore to size.

Note, however, that if the indicator were mounted with its plunger lying horizontally, the screw for adjusting the cutter-bit could be set exactly by watching the movement of the indicator needle.

Centring Work held in the Four-jaw Chuck

This is an operation so often needed that, at various times, holders for mounting the test indicator on the lathe have been made, with the object of obtaining quick and convenient working. One

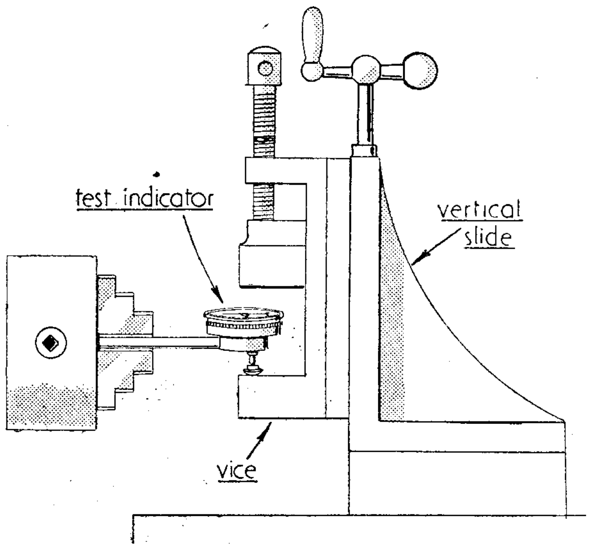


Fig. 1. Aligning the fixed vice-jaw with the test indicator

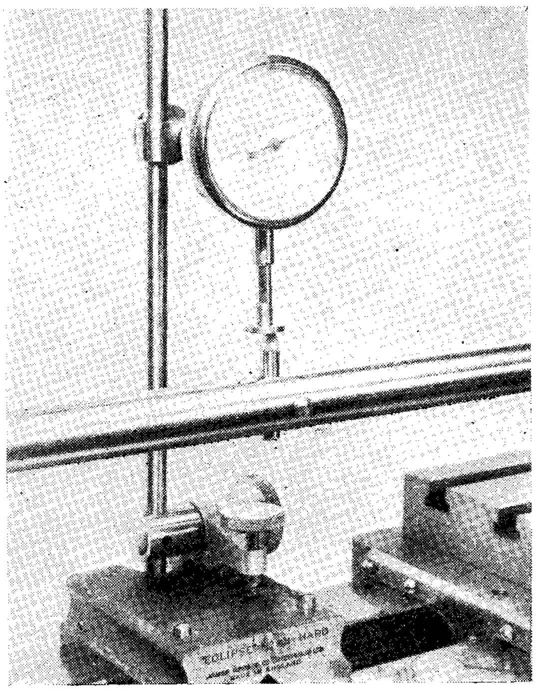


Fig. 2. (right): Showing an accurate method of setting a tool-bit

of the earliest of these holders, described in a previous article, was designed to clamp on to the lathe tool, and the indicator was attached by means of its clamp to a small spindle fitted to the body of the base clamp. Another device for the same purpose is illustrated in Fig. 3. This is very quick in action, as the split spindle at the right is pushed into the tunnel of the topslide feed-screw, and the attachment is then secured in place by giving a half turn to the knurled finger-nut which draws in the tapered expander-bolt. As will be seen, adjustments can be made in every direction and, in the ordinary way, it is only necessary to set the anvil at lathe centre height when tightening the locking-screw. To enable any reader to make the holder, the working drawings are given in Fig. 4.

The sleeve-clamp, in which the shank of the indicator is held, is the standard Starrett fitting, and this also forms part of the larger, Eclipse surface gauges. The latest mounting for the test indicator, illustrated in Fig. 5, has so far proved the most useful. This consists of a U-shaped bracket, fitted with a spindle to carry the standard indicator sleeve-clamp.

Although the holder is generally used by gripping it under the clamp handle of the four-tool turret, it can equally well be mounted under the nut of the ordinary toolpost. In any case, once the holder has been adjusted, the plunger of the indicator will always come to lie at lathe centre height.

With these two holders, the indicator dial faces the operator and the plunger lies horizontally. Therefore, when centring work in the four-jaw chuck, the mandrel is turned by hand until the indicator registers the point of greatest run-out, and it is then only necessary to slacken the far jaw and to turn in the near chuck jaw, until the indicator needle shows that the work has been set back for a distance equal to half the total run-out.

Should the point of maximum run-out lie between two jaws, adjust one pair of jaws at a time.

To give a more finished appearance, the body of the holder was blued. Small parts can be finished in this way, merely by heating and dipping in oil, but it is not always easy to get even colouring on a large, steel component. One method is to heat the work evenly in a sand-bath, or a muffle furnace with temperature control can be employed. On the other hand, chemical blueing gives a pleasing finish, and is easily

(*Continued on page* 602)

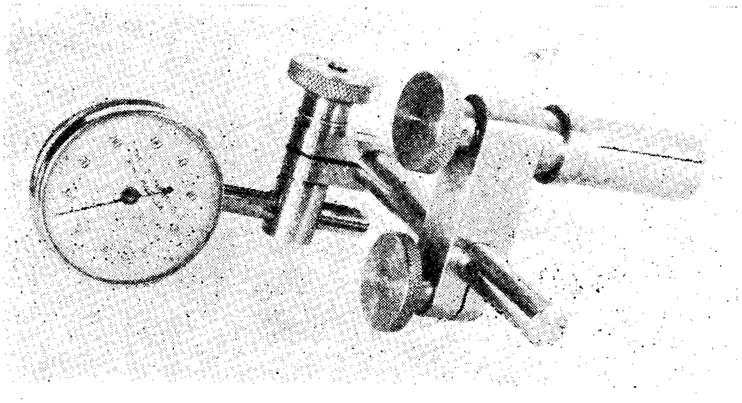


Fig. 3. A holder for mounting the test indicator in the lathe topslide

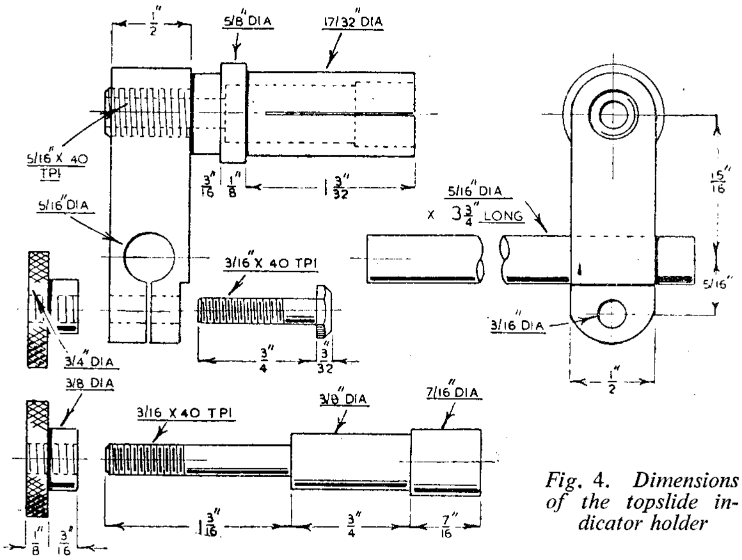


Fig. 4. Dimensions of the topslide indicator holder

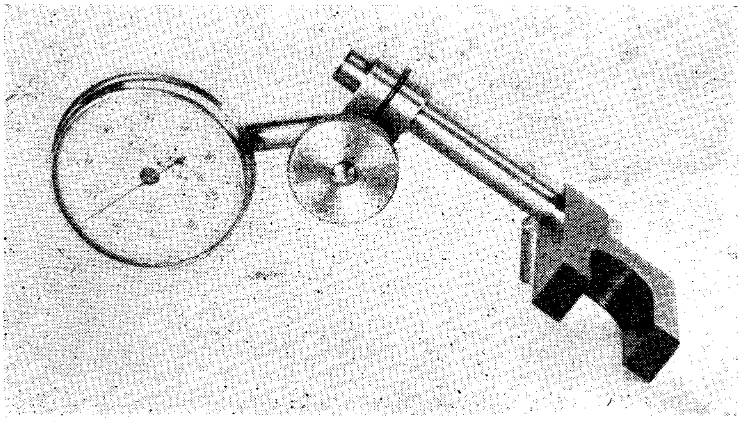
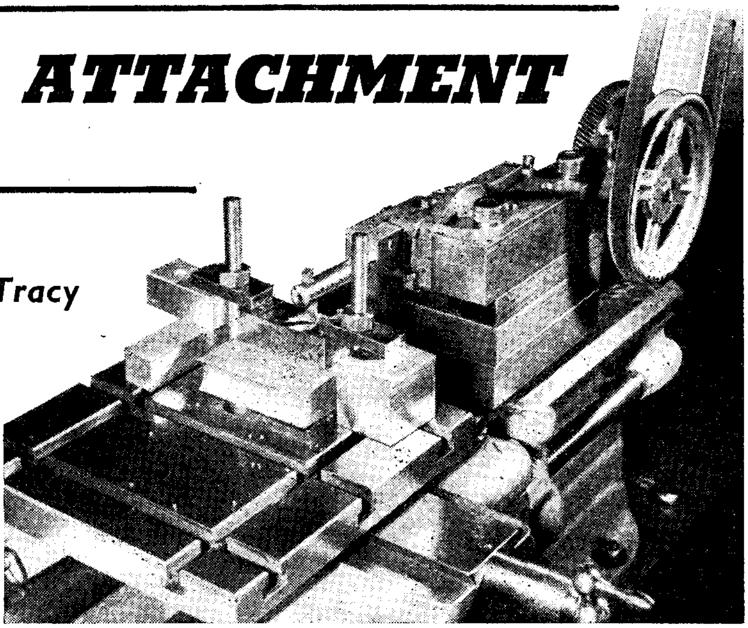


Fig. 5. A toolpost mounting for the test indicator

A SHAPING ATTACHMENT

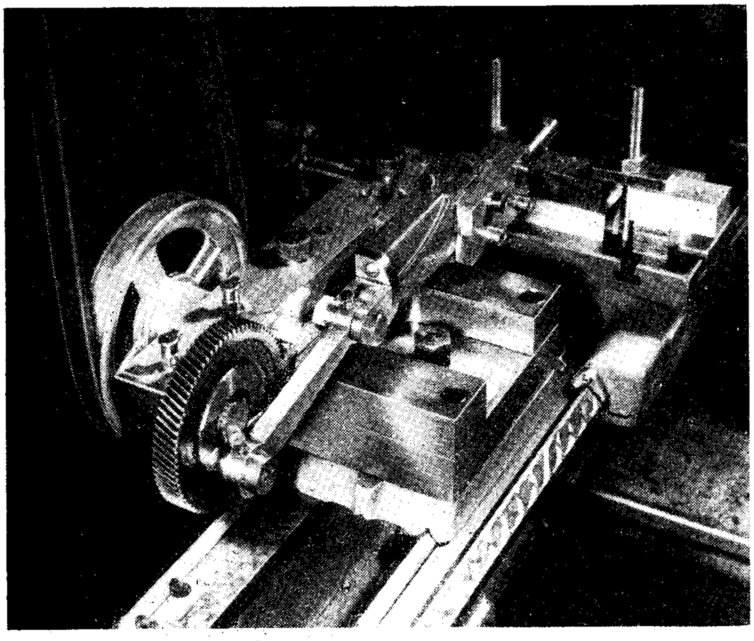
for the lathe



By W. W. Lacey and J. Tracy
(New York)

MOST amateur machinists have encountered the job where an internal planing operation seems the only satisfactory solution. The most common of these is the cutting of an internal keyway in a pulley or gear. On the other hand, few hobbyists possess a shaping machine on which such work is normally done. However, many shaping jobs are small enough to fall within the scope of this attachment, which has a stroke of 1¾ in. With such an attachment, the amateur also is able to form internal splines, and square or hexagon holes, etc.

This machine can be readily assembled by anyone with a lathe and the small amount of cash required to purchase the lathe replacement components needed. They are surprisingly inexpensive. The chassis is a piece of cold rolled steel, 1½ in. square and 10¼ in. long. One end is bored for oilite bushes as shown. These holes were internally counterbored larger in their central portion, to form an oil reservoir between the steel body and bronze bushing, from which lubricant percolates through the porous bronze to the bearings.



The attachment in use, viewed from tailstock end of lathe bed

The gear spindles are both simple turning jobs, but the mesh of the gears should receive attention. In this case, one bush was finished with internal and external holes slightly eccentric. By rotation of the bush when only partly inserted, the correct gear mesh was obtained. Both bushes were then pressed home.

It was necessary to skim up the gear bores to ensure true running and to create an accurately squared face for the crankpin. The spur-gear is held to its spindle by a central cap screw; since this takes no torque, no other security is needed. The pinion is secured to the pulley shaft by a longitudinal dowel, half in the gear and spindle, the other half in the retaining screw acting as a key.

After the crankpin was inserted, a small hole was drilled from the reverse side of the spur—half in the gear and half in the crankpin. A pin was driven in this hole, acting as a key, to prevent the crankpin from turning. A cap screw was fitted to this end to hold the crankpin. A retaining cap is held with three countersunk flathead screws to secure the big-end of the connecting-rod on the crankpin. There is, therefore, no tendency for the cap to unscrew when in motion.

The cross head clevis is cut on the lathe by chucking a 1½ × ¾ in. cold-rolled bar in the four-jaw. A clevis pin-hole was drilled and reamed. A cut-off tool formed the fork and cut off the finished clevis.

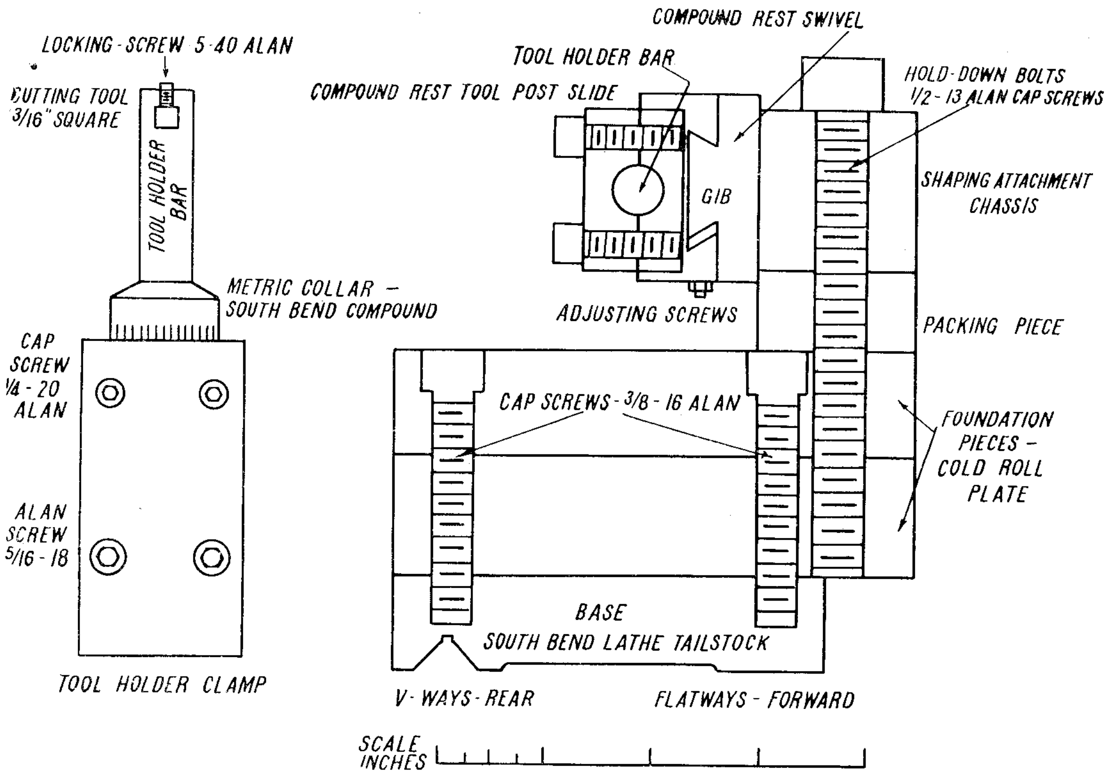


Fig. 1. The foundation structure

The clevis base was formed from $\frac{5}{8}$-in. × $\frac{3}{4}$-in. steel. Roundhead screws were necessary, since the existing threads in the compound topslide (which acts as ram) do not match Alan threads.

The compound rest and swivel fit together on a sliding dovetail. It is provided with gib and screws for take-up, for wear.

The connecting-rod was marked out on $\frac{3}{8}$-in. × $1\frac{1}{2}$-in. cold rolled bar. The tapering sides were cut with an end mill, the work being held in the vertical-slide, and the rounded ends were sawn, filed and ground to profile. The rod, again held in the vertical-slide, is first checked for squareness with lathe bed by trial against the faceplate. After the first hole was finished, the top-slide was traversed and tightened for the second without disturbing other settings, thus guaranteeing parallelism of the two holes. The two eyes of the connecting-rod were then bushed with oilite bronze.

Aligning the compound rest swivel is important to insure cuts parallel to the bedways and to the headstock spindle. This was done as follows: The swivel is attached to the chassis by two countersunk flat-head screws. The holes and countersinks for these screws were drilled and bored with the swivel clamped to the lathe faceplate. One of these was marked out on the chassis, and inserted temporarily to hold the swivel in position. A clamping attachment was then made, bringing adjustment screws to bear on either side of the swivel, to act as adjustment and clamping jig at the same time. The chassis was then rested on a flat plate and a piece of drill rod laid across the upper dovetail. The jig screws were adjusted until a surface gauge could detect no difference in elevation at either end of the drill rod.

Next, holes were drilled and register pins driven in. Finally, the hole for the second screw was drilled and tapped with the swivel in situ. With the second screw driven home, the clamping jig was removed, having served its purpose.

The replacement tailstock base furnished by South Bend Company provides a preformed, accurate component on which to build a base of the machine. It was necessary to mill off three lugs to leave the upper surface free and flat for further structure. Two main pieces of cold-rolled plate were cut, the upper one being cut out horseshoe shape, to save weight, and to permit use of the bolt provided for the base by the South Bend Company. These pieces were faced on the lathe faceplate, to ensure parallelism of upper and lower surfaces. A $\frac{3}{4}$ in. packing piece was placed immediately beneath the chassis, bringing the tool holder bar level with lathe centres.

Variation of thickness of packing provides gross adjustment of depth of cut. Finer adjustment is provided by resetting of the cutting bit in the tool holder bar. Still more critical adjustment is made by rotation of the tool holder bar. So that an earlier setting can be easily restored, a lathe metric collar was fixed on the tool holder bar.

No relief was provided in the form of a clapper box, since this would greatly limit the scope of work of

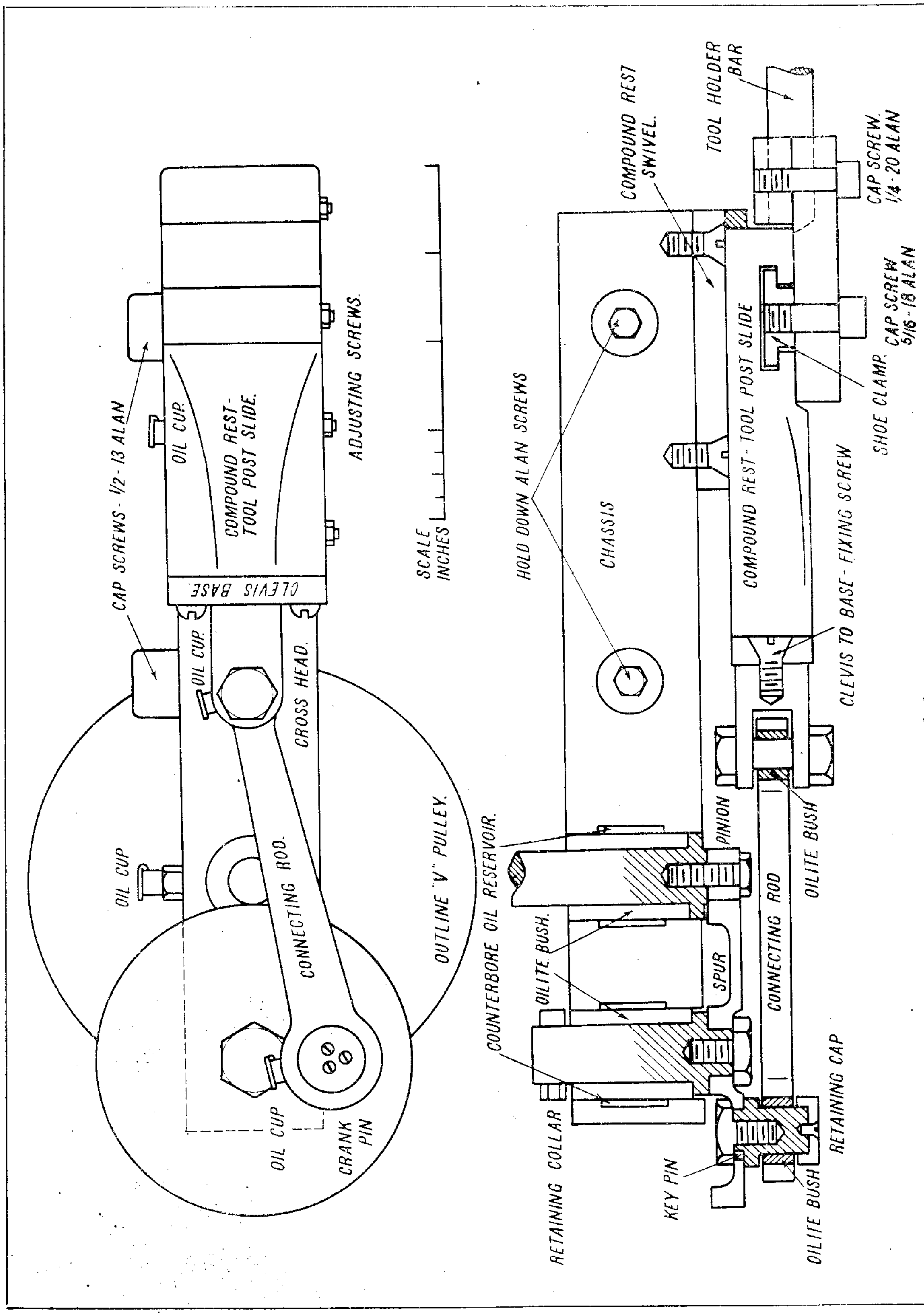
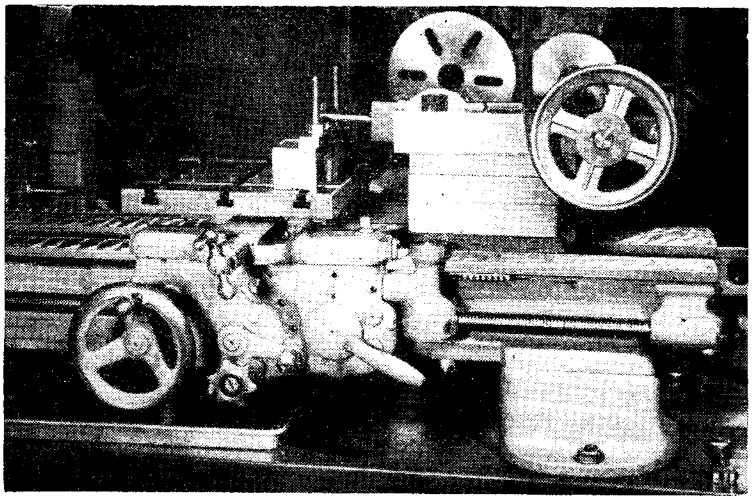


Fig. 2. Elevation and sectional plan

the machine. Such relief is not essential as many familiar cutting tools have no relief; viz, taps and dies which are alternately pushed forward to cut, and drawn backward, unrelieved, to clear chips and swarf.

The unit is driven from an overhead motor ($\frac{1}{4}$ h.p.) and jackshaft, via a $\frac{1}{2}$ in. V-belt. Speed of the shaper is altered by use of change-pulleys on motor and jackshaft.

The photographs show the unit mounted in place of the lathe tailstock, and planing a piece of material clamped to the boring table on the carriage. In this position, the lathe cross-slide provides the feed. The machine can also be bolted to the boring table, from which position it is capable of working on material held in the headstock chuck. In conjunction with the headstock spindle and indexing gear also built for this lathe, various splines and internal shapes may be produced.



A view from the front of lathe bed

Through the use of finished lathe components, much of the exacting work is eliminated while, at the same time, a good deal of accuracy is assured in the finished product through the use of ordinary care in assembly. Moreover, through the use of robust proportions in structure, this machine runs smoothly and cuts without apparent signs of effort. It has repaid its time in building by greatly widening the scope of work possible in the shop.

USING A TEST INDICATOR IN THE LATHE

(*Continued from page* 598)

carried out with a suitable preparation. In this connection, excellent results have been obtained by using Bell's Rapid Gun Blue, supplied by the Precision Model Engineering Co. of 61, Paradise Street, Liverpool 1.

Test Indicator Anvils

Some variation of the usual mushroom type of anvil with a curved contact surface is often needed. For example, when setting a round bar on the lathe boring table, so that it lies parallel with the lathe axis in both the vertical and horizontal planes, it is essential to use an anvil with a flat contact face. Again, the work may have to be set to run true from a narrow face close to a shoulder, and an extended form of anvil is then necessary.

The anvils illustrated in Fig. 7, can readily be made in the workshop. If a $\frac{1}{8}$ in. $\times$ 60 t.p.i. tap is not available for cutting the standard thread for attaching the anvil, a plain bore can be drilled to engage the end of the plunger and, as shown in the illustrations, the anvil is then secured by means of a 10 B.A., duralumin clamp-screw with a knurled head.

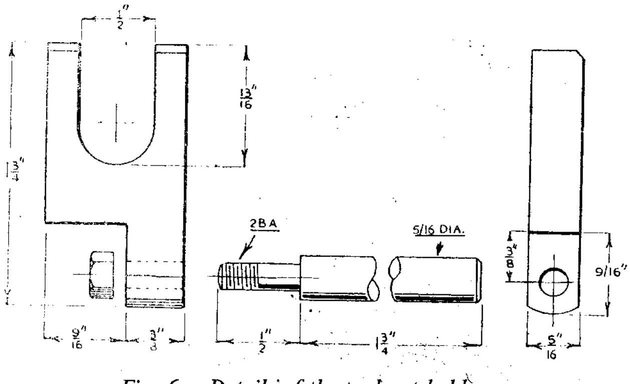


Fig. 6. Details of the toolpost holder

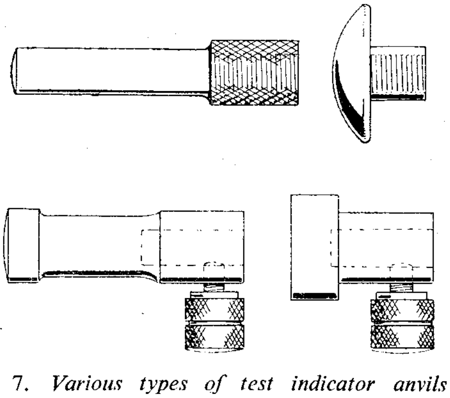
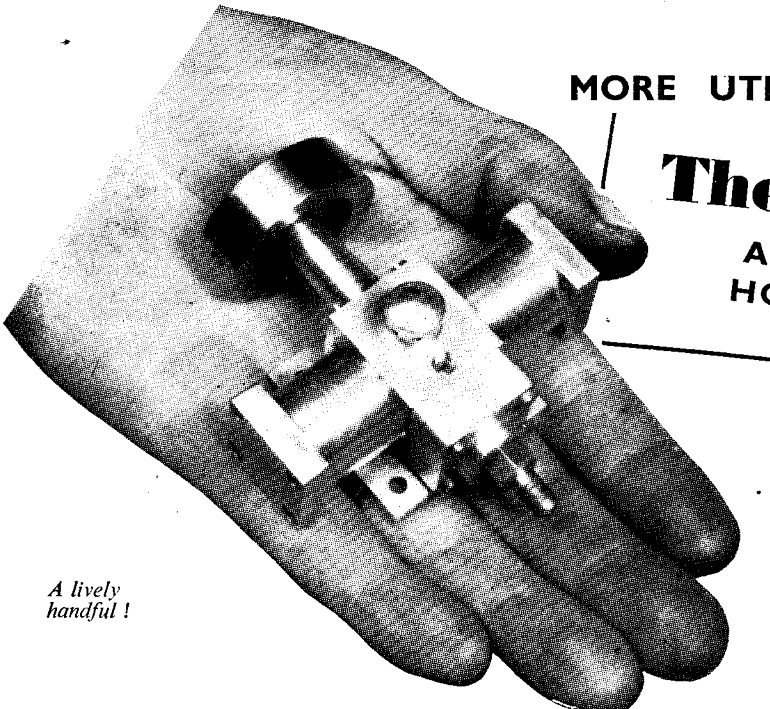


Fig. 7. Various types of test indicator anvils



MORE UTILITY STEAM ENGINES

The "Cygnet"

A SINGLE-ACTING HORIZONTAL TWIN

By Edgar T. Westbury

A lively handful!

THE body of the engine, as previously mentioned, is made in duralumin, but the use of a high-tensile alloy for this component is not absolutely necessary, and any light alloy, either cast, extruded or rolled, can be used, provided that it is sound, and of good machining quality. Aluminium in its unalloyed form, however, is not suitable, as it is too soft, and very difficult to machine to a good finish. This applies to the other light alloy components, with the exception of the two connecting-rods and the piston yokes, which must be of duralumin or other high-tensile alloy.

Alternatively, the structural parts may be made of other metals, such as cast-iron or bronze, which may have advantages in certain respects, but will naturally result in a heavier engine. If bar stock material is used, of $\frac{7}{8}$ in. square section, it will normally be accurate enough to use without any preliminary external treatment, but if sand-cast, it should first be trued up by filing or machining to provide reference surfaces for marking out.

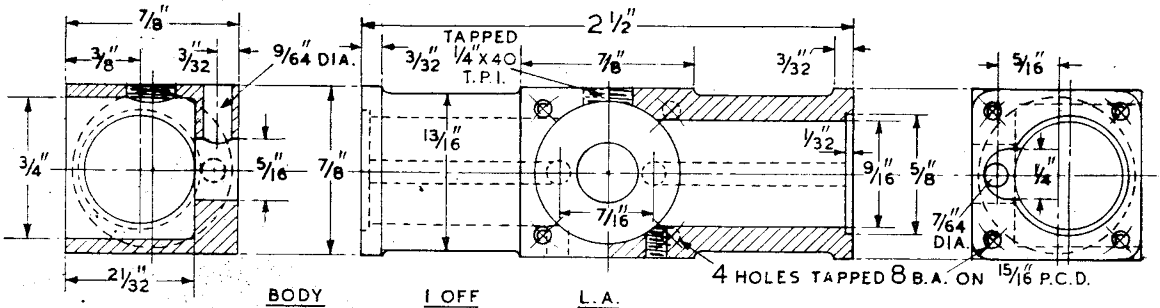
The main bore which forms the seatings for the cylinder liners is offset $\frac{1}{16}$ in. from the centre of the material; it can be bored from the two ends if desired, but I found it easiest to run the drill through the full length, followed by a boring tool. A $\frac{9}{16}$-in. reamer may be used for finishing to ensure a truly parallel bore, but if this is not available, tool finish is satisfactory so long as due care is taken. These operations may be carried out by holding the piece by one end in the four-jaw chuck, having previously marked out the bore centre, and setting this to run truly; then the end is faced and deeply centre-drilled to enable the drill to start accurately. After boring, and forming the recess to locate the lip of the liner, the work may be mounted on a mandrel for facing the other end to correct length and forming the other recess.

The surplus metal around the cylinder barrels may be turned away by re-mounting the work in the four-jaw chuck, on its main centre this time; it will be necessary to do one end at a time, and after the first end has been done, fit a split bush or four packing-pieces over the turned part to enable it to be gripped in the chuck without damage; do not try to hold it by the thin flange at the end or it will surely move when turning the overhanging end.

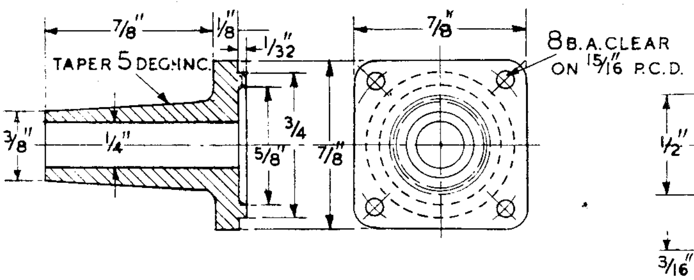
The object of this operation is simply to lighten the engine structure; to carry this idea to its logical conclusion, circular milling would be preferable, enabling the external surface to be machined concentric to the liners except at the back, where a rib of metal must be left, wide enough to enable the steam ports to be drilled. But the saving in weight obtained in this way hardly makes the additional work worth while.

For boring the body crosswise to form the crankcase barrel, it may be mounted across the jaws of the four-jaw chuck, two of the jaws being inverted. Packing-pieces of

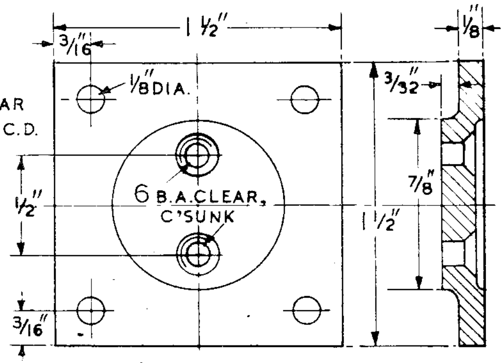
Continued from page 547, November 5, 1953.



BODY 1 OFF L.A.



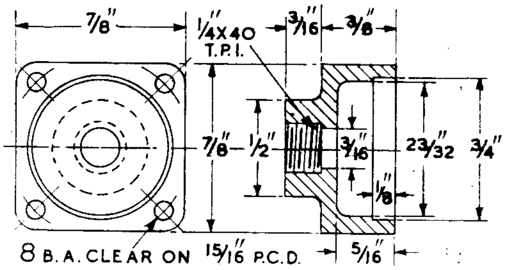
MAIN BEARING HOUSING 1 OFF L.A.



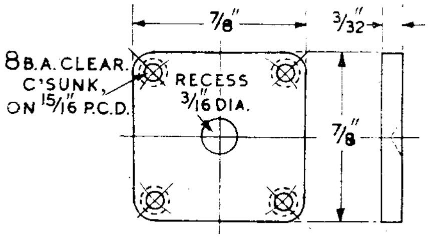
BASEPLATE 1 OFF L.A.

wood, fibre, or soft metal should be used at the ends to prevent bruising the machined faces. Make certain that the work is square both ways, and the centring is accurate in respect of both length and width. It will be necessary to skim the face to ensure a true seating for the flange of the bearing housing, but this should only remove a few thousandths of an inch of metal; the cut may with advantage be run out to clean up the outer flanges to the same level as this surface. Bore the through hole concentrically to $\frac{5}{16}$ in. diameter and counterbore $\frac{3}{4}$ in. diameter to a depth of 21/32 in. from the front face. The work is then mounted on a pin mandrel for facing the rear side, including the edges of the end flanges. Other operations on this component may be left till a later stage; they consist in drilling the ports, drilling and boring, and turning of the spigot should be carried out at one setting to ensure concentric truth, and as the fitting of a very shallow spigot to a "snap" fit is liable to be a tricky business, the beginner may find it worth while to waste a little material by making the spigot longer than is necessary at first, afterwards cutting back the front face as required.

It may be possible to turn the outside of the housing at the same setting as the boring operation, or at least to rough it down, preliminary to finishing by mounting on a mandrel. The exact diameter and angle of taper on this part are not critical. For drilling the screw holes in this part, also the cylinder covers and steam-chest (note that they are all on the same pitch centres) I strongly recommend using a drilling spindle on the lathe, in conjunction to each other, they are not so precise in their location relative to the square edges of the flange (or should it be *vice versa*?) because of the difficulty in initial angular location of the work itself. This can be overcome in a very simple manner, assuming that the drill spindle is set exactly at centre height, as it should be and the lathe bed is level in the cross plane. A combination rule, of the type having a mitre-square with a spirit level incorporated, can be used to locate the sides of the flange, ensuring that they are exactly at 45 deg. to the horizontal centre-line, before setting the indexing gear. In the absence of this very useful instrument, I have used a cheap spirit level with a simple angle gauge attached.



STEAM CHEST 1 OFF L.A.



CYLINDER COVER 2 OFF L.A.

Steam-chest

This can be made from the same tapping-holes for fixing screws, and the crankcase breather, and milling or boring shallow recesses in the end faces to connect the steam ports with the cylinders.

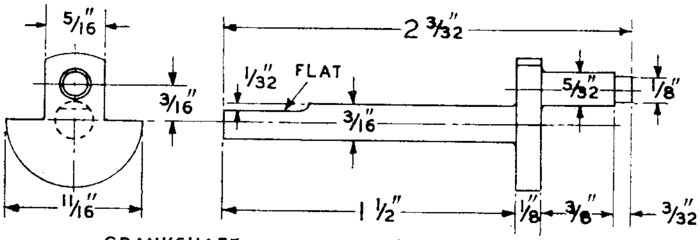
Main Bearing Housing

This can also be made from $\frac{7}{8}$ in. square light alloy, but if this is not available, round material not less than $1\frac{3}{16}$ in. diameter will serve, as the square sides of the flange can be shaped afterwards. The facing, with a simple form of headstock indexing gear; the parts can be dealt with while set up for machining, and the accuracy of the location of the holes is thereby assured. The tapping holes in the body can, of course, be "spotted" through with the parts in position.

Here is a tip worth knowing when drilling holes in square flanges by this method. Sometimes it is found that although the holes must necessarily be correctly located at 90 deg. size material as the bearing housing, and is held in the four-jaw chuck for drilling through concentrically $\frac{3}{16}$ in. diameter, counterboring $\frac{3}{4}$ in. diameter at the mouth for a depth of $\frac{1}{8}$ in., and to 23/32 in. diameter for $\frac{5}{16}$ in. depth, at the same setting.

The outside end of the steam-chest is arranged so that either a flanged or a union joint can be used for the steam inlet connection. It is, therefore, provided with a boss $\frac{1}{2}$ in. diameter, which would be

suitable for connecting a circular flange for a $\frac{1}{8}$ in. steam pipe; the hole is opened out and tapped $\frac{1}{4}$ in. by 40 t.p.i. for a depth of $\frac{3}{16}$ in., but for reasons which will appear later, the inner end of the hole should not be more than $\frac{3}{16}$ in. diameter. Generally speaking, union joints are preferable to flanges for engines in boats or other cramped positions, as it may be found difficult to manipulate fiddling little flange bolts or gaskets in such cases.



CRANKSHAFT 1 OFF M.S.

I had thought of incorporating a displacement lubricator in the steam-chest, but decided that it would be better to treat this as a separate item. Continuous internal lubrication is very important in a high-speed engine, and the simple hydrostatic displacement lubricator is not always found entirely satisfactory; some experiments with lubricators are overdue, and will be attended to as soon as possible.

Cylinder Covers

These are simply flat plates, as it is not necessary to provide a register to locate them to the cylinder bores. They may be made from sheet metal, but I prefer to make them from bar material by facing and parting-off, as this ensures true flatness. The dimple in the centre is intended to provide clearance for the slight projection of the yoke spigot in the piston-head, without increasing the total head clearance more than is absolutely necessary. If machined in the manner suggested, and the drilling spindle employed to locate the holes, these may be drilled deep enough to pass through both covers, with parting-off allowance, at one indexing. These covers, also the flanges on the body, bearing housing, and steam-chest, but *not* the central portion of the body, may have the corners rounded off as shown, to improve the appearance.

Baseplate

This is fitted to simplify the mounting of the engine on a flat surface, as it enables it to be held down by four readily accessible screws at the corners of the plate. In a boat, it may be found desirable to use other methods of mounting, such as bearers attached to the endplates, but this is the simplest method where it is readily applicable. I may mention that if I were designing an engine of this type to be made from castings, I should prefer to incorporate feet in the body casting, for mounting purposes, also to increase the size of the crankcase, including a sump, as deep as possible, consistent with the centre-to-base clearance permissible in the boat or other installation.

The baseplate has a circular boss on the top surface, $\frac{7}{8}$ in. diameter, to make a good area of contact with the underside of the body. It is not registered or otherwise positively located, except by its fixing-screws; but it is a good idea to drill a small hole through the centre of the plate when turning the boss or the underside recess, and locate this over a centre marked out on the body when spotting the holes for the two screws. The front and rear edges of the plate should lie square with the centre-line of the engine shaft.

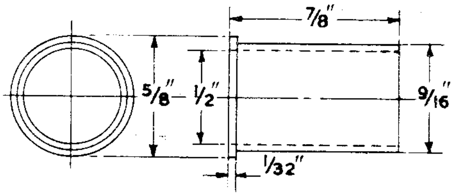
Crankshaft

Having machined the light alloy structural parts, attention may now be paid to the internal working parts, which are mostly in harder or tougher material. The crankshaft will be satisfactory in mild-steel, though better material, such as nickel chrome, will be much more durable if available. It may be fabricated if desired, but I find it easier and more satisfactory to machine it from the solid, for an engine of this size. The methods employed have been described on several occasions in THE MODEL ENGINEER; briefly, they consist of turning the main journal, or at least roughing it down exactly parallel and using this surface to locate it in an eccentric chucking-fixutre, such as a vee-angle plate, to machine the crankpin. Most of the unwanted material at this end can be sawn away before this operation, to reduce the amount of turning required. The essential thing is that the axes of the main journal and crankpin should be exactly parallel with each other, and that the amount of throw, or eccentricity of the crankpin, should be as close as possible to the specified dimension, $\frac{3}{16}$ in. Both the surfaces should be smooth and parallel; it is advisable to leave them about 0.001 in. oversize from the tool, and finish with a ring lap, but the actual dimension must, of course, be related to that of the main and connecting-rod bearings.

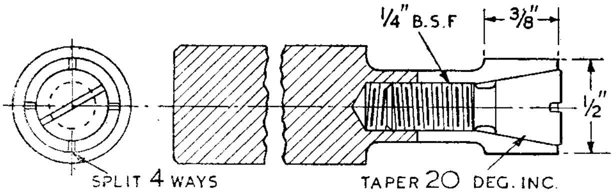
A flat is formed on the end of the main journal to facilitate the securing of the flywheel by means of a sunk grub-screw. This is not in line with my usual methods of fixing flywheels, by means of a taper or a split collet, but it is quite satisfactory in this small engine, and has the merit that if the flat is formed in the position shown, the screw in the flywheel will always indicate dead centre.

Flywheel

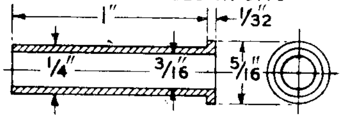
Any odd piece of steel, cast-iron, brass or bronze may be used for this component; its dimensions are not critical, but it should be accurately turned all over, and closely fitted to the shaft. It will be seen that the hole for the grub-screw is drilled right through the main web to give an ample length of thread, and is counterbored to enable a headed screw to be used so that it can be tightened up much more firmly than is possible with the usual headless screw; an Allen type socket-head screw could be used with advantage. If the engine is intended to run at very high speed, it is advisable to check up on the balance of the flywheel, with the screw fitted in its normal working position. Whatever type of flywheel is used, concentrate as much of its mass as possible in the rim; if it is merely massive, without proper distribution of mass, it adds unnecessary weight to the engine and is not proportionately effective in carrying out its designed function.



CYLINDER LINER 2 OFF C.I.



Adjustable lap for finishing bores of cylinder liners



MAIN BEARING BUSH

1 OFF C.I.

Cylinder Liners

Close-grained cast-iron, as obtainable in stick form for making valve-guides and similar purposes, is recommended for these, and they may be machined all over, inside and out, at one setting, then parted off. They look rather fragile, as indeed they must be in a lightweight engine, but are quite robust for their job, and easy enough to make by the above methods. The outside should be made a light press fit in the bore of the body; it is permissible to make them about a thou. taper, so that they go in quite easily for two-thirds of the way, as this simplifies insertion. Make certain that the lip will go into its recess—not necessarily a snap fit—and it may be made to stand slightly proud, for facing off when in position.

Finishing the Bores

The inside surface of the liners should be bored as accurately as possible to produce a smooth, parallel surface straight off the tool; reaming is not recommended, as the results obtained are not always as accurate as they look, but a really good D-bit will produce an accurate hole if properly applied. In any case, however, the precision required for really efficient results with an unpacked piston can only be obtained by lapping, an operation which calls for a little skill and a lot of patience. Methods of lapping have often been described in THE MODEL ENGINEER; my own methods do not coincide with everybody elses, but I have found that they produce the desired results. For small liners, I run the lap in the lathe, at moderate speed, and hold the work in the fingers; this enables the operation to be judged by touch, as any change in friction, general or local, can instantly be felt, and in the not unlikely event of a partial seize-up, no harm whatever is done.

A Simple Expanding Lap

The lap may be made from a piece of copper or aluminium rod, turned to ½ in. diameter at the end for a length of ⅜ in., and necked down for a length of about ⅝ in. behind this. A hole is drilled and tapped ¼-in. B.S.F. down the centre, about 1 in. deep, and the mouth bored out taper to 20 deg. included angle to take a similarly shaped expanding screw; finally, the lap is split three or four ways, the cuts being extended at least ¼ in. beyond the head of the lap. This makes a very serviceable type of tool for dealing with any small bores, and is particularly useful if the bores are blind, as it has no projections beyond the head; but readers are well advised to avoid blind bores for things that matter, wherever possible.

Another thing which I consider undesirable is the use of a long lap in relatively short bores. Admittedly it will work faster, as a greater area of the lapping surface is in action; but it increases the tendency to produce bell-mouthing of the bores, and makes local correction difficult or impossible. I make the lap head just long enough to give reasonable axial guidance, and then if any part of the bore tends to be tight, it is possible to concentrate on a short length of it until it is corrected. Other than this, the work (or the lap, according to the method of operating) should be kept reciprocating, and on no account should it be allowed to stay in one place in the bore; normally, the lap should emerge just enough to be visible at each end of the stroke.

Some workers consider it desirable to use a different lap for each grade of abrasive, but I find that the extra work entailed in making a number of laps is hardly justified by any apparent benefit in results. Reasonable care in cleaning the lap when changing to a finer abrasive seems to be sufficient; the bore surface should, of course, be cleaned as well, and after lapping is completed, the most scrupulous care must be exercised in ensuring the removal of the last trace of abrasive material.

The first stage of lapping should be carried out with a fairly sharp abrasive such as fine carborundum, the use of which should be continued until inequalities, not only of appearance but also of feel, are eliminated and the surface is a smooth matt all over. Successively finer grades of abrasive, such as aluminium oxide, flour emery, etc. down to Tripoli or rouge may then be used to improve the finish. I find very little advantage in using *liquid* metal polish for final finish, and I am doubtful whether it does any lapping at all, as it is largely a chemical cleaner, apart from a small amount of fine silica which it contains, and it imparts only a very superficial lustre to surfaces; but the old-fashioned paste polishes (which contain Tripoli), and plate powder, are certainly effective. One simply cannot hurry lapping processes, which are inherently slow and tedious, but definitely *do* produce results! To cope with any possible risk of distortion in pressing in the liners, the final lapping should be carried out *in situ.*

Steam engine constructors may smile tolerantly and say that all this lapping business is unnecessary; true enough, it is rather unusual in small steam engine practice, but with due respect, I point out that the possibility of achieving perfect pressure sealing by the use of this process, and its influence on engine efficiency, has been fully proved on small i.c. engines, and logic indicates that it must be equally effective in engines working on steam or any other form of pressure. In fact, the results obtained on the engine now under discussion provides concrete evidence of this.

Main Bearing Bush

This is also made in cast-iron, and can be machined all over at one setting; it should be a press fit in the housing, and in this case a reamed bore is permissible, though lapping would be worth while if one is prepared to take the trouble; in any case, however, the final operation should be carried out after the bush is inserted. It will be seen in the general arrangement drawing that an oblique oil hole is drilled from the inner face of the housing into the bush, which should be done. Alternatively, the crankshaft may be drilled up the centre, with a small side hole, to convey oil as near to the centre of the length of the bush as possible.

(To be continued)

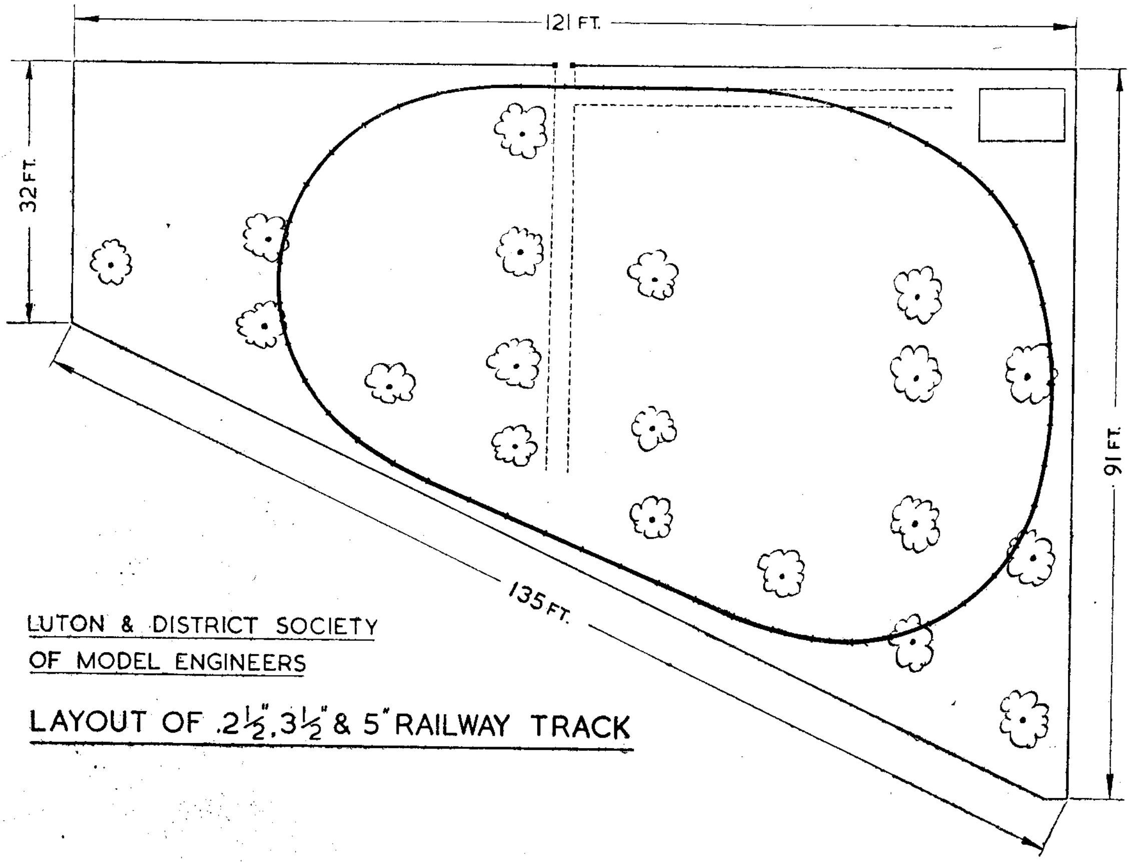
The Luton Society's New Track

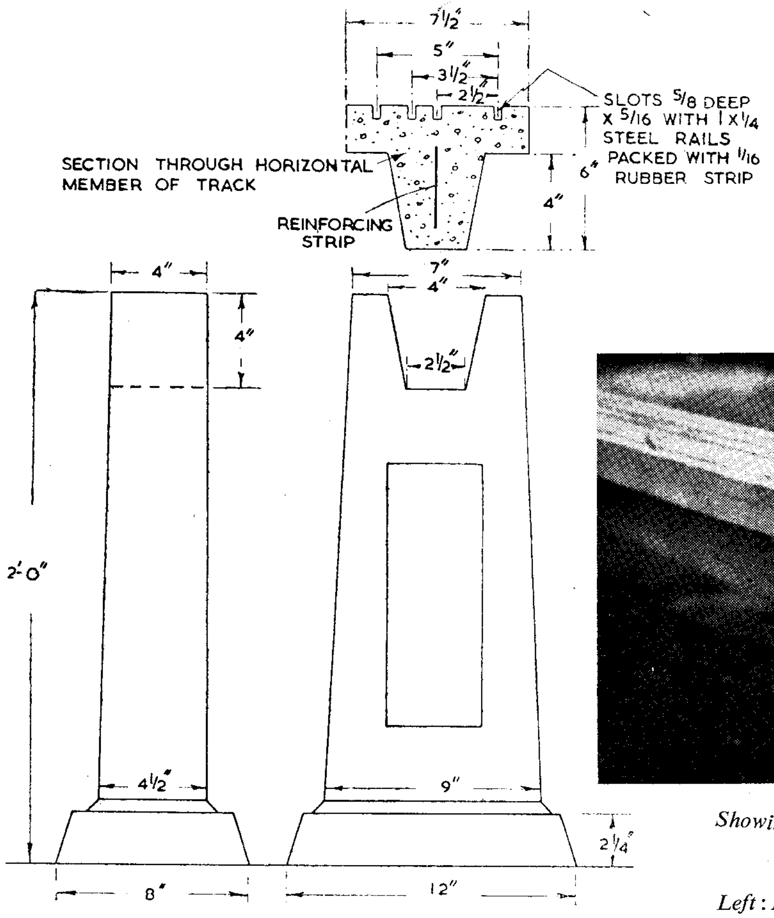
By W. Buckley

Mr. E. W. Fraser and Mr. Warren watch the Television camera man. Just showing, Mr. Fraser's " Colne Springs "

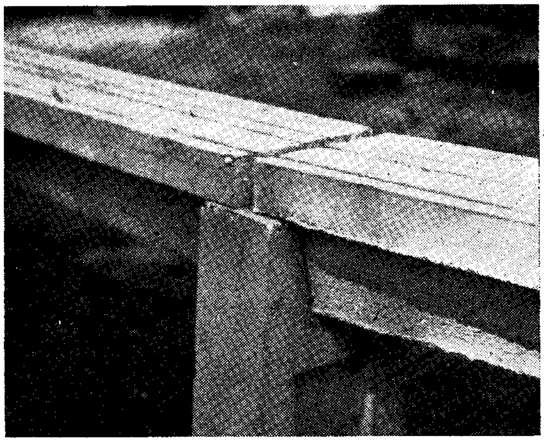
THE Luton Society welcomed many visitors from neighbouring societies and a cameraman for Children's Television Newsreel when the new locomotive track was opened, in somewhat dismal weather, in August, at the culmination of 18 months of hard work, which has resulted in a track which, though relatively small, compares favourably in design and performance with any in the country. It is situated at the rear of 31, Compton Avenue, Luton, and access is gained by a gateway at the rear of Filmer Road.

The land on which it has been built is 121 ft. × 91 ft. at one end, but only 32 ft. at the other, and although not ideal in shape, has been exploited to accommodate a track which is unusual enough to avoid monotony, and lends itself to very satisfactory performance





Left: *End and front elevations of the standards*

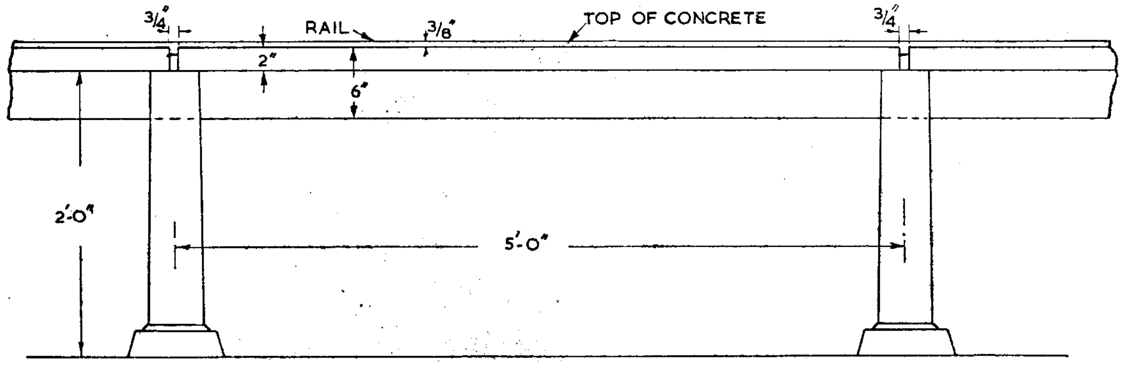


Showing two sections of track resting in the upright standard

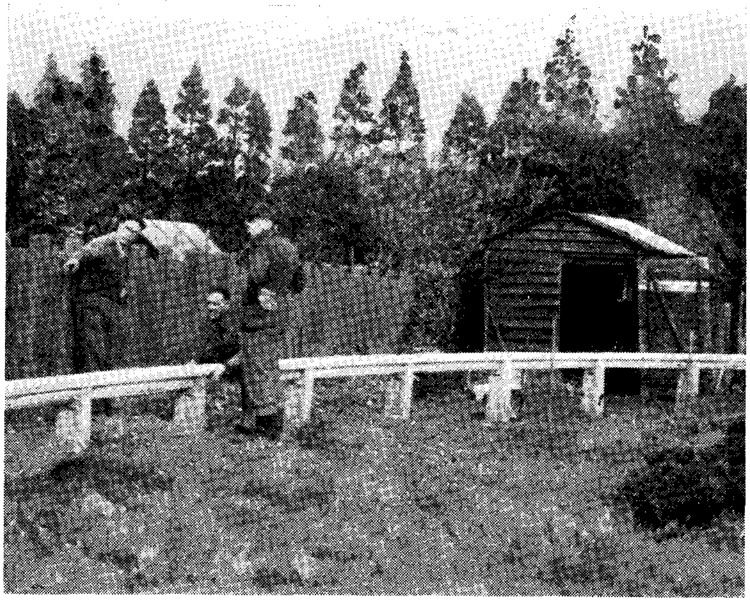
with particularly smooth riding characteristics, the result of careful levelling and dowelling the butt ends of the steel rails. The design, shape and construction of the track was the result of many hours of discussion at the well-attended meetings of the society, when ideas were welcomed, examined and accepted or discarded according to their virtue or otherwise, and this method paid handsome dividends when the practical work of construction was put in hand. The use of a dumpy level in the initial stages showed that the land had a slope of approximately 5 ft., and with the minimum amount of digging in view, three sizes of upright standard were adopted to enable a level track to be built.

The railway is roughly pear-shaped in plan view with a 25 ft. radius curve at the top, two straight sides and generous curve of 50 ft. radius at the base, transition from the "straight" to the 25 ft. radius curves being *via* 50 ft. radius sections which also have a slight banking twist, giving a very smooth ride into the curve, "locomotive tail waggle" being noticeably absent even at speed.

The 5 ft. reinforced concrete spans holding the four lines which make up the 5-in., 3½-in., and 2½-in. gauges are of T-section and were cast upside down in formers, straight, 50 ft. radius and 25 ft. radius, the bases of which were of sheet metal fitted with four "rails" ⅝ in. deep



Side elevation of track mounted on standards



A general view of part of the track

× $\frac{5}{16}$ in. wide for forming the line slots in the concrete. The three moulds were farmed out among the members for construction, and upon completion, the concrete work was put in hand at the rear of one of the member's premises.

As far as possible, the schedule of a cast out of each mould (i.e., three spans and three standards) twice a week was the target, and thanks to a nucleous of devoted and extra keen members, this schedule was maintained. Fortunately, among those interested were two concrete shuttering experts, and thanks to their guidance and example, a very good quality of casting resulted. While this work was in progress, those who could be spared undertook preparation of the ground, digging out a shallow cutting, levelling, etc., and as the concrete work hardened, commenced erection.

The concrete castings were all ready and able to be erected before the winter which settled the disturbed ground and hardened off the concrete so that spring saw the work of relevelling commence, and the fitting of the 1-in. × $\frac{1}{4}$-in. lines into the slots on and between rubberised packing strips.

The horizontal members of the track have zig-zag reinforcing wires inserted, as well as the reinforcing strips.

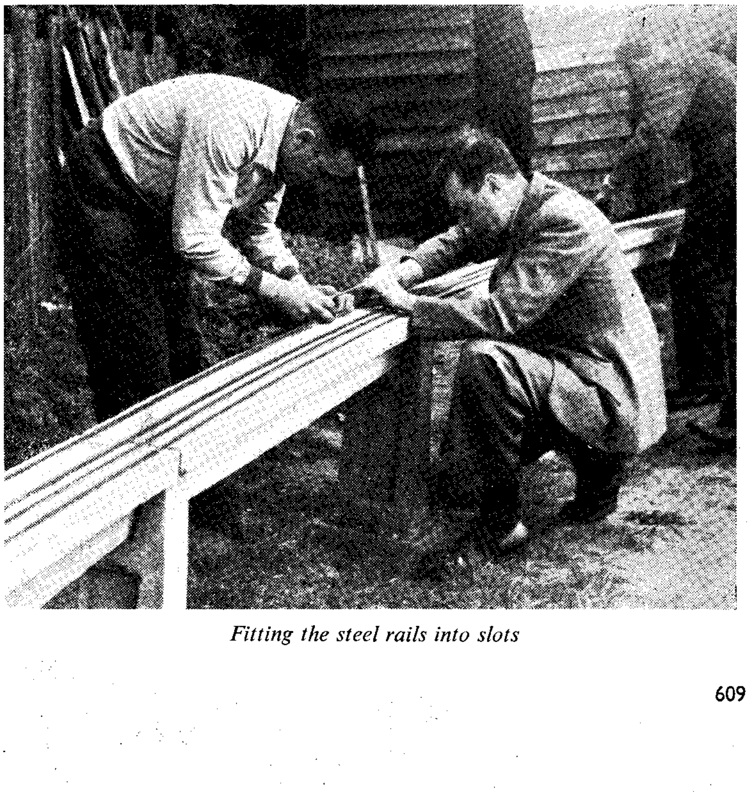
The lines were first prepared by milling the ends square and jig-drilling the butts to take dowells in order that accurate "butting" would be maintained. The bedding in rubberised strip, and finishing with black bitumastic paint over the whole of the top face has resulted in a remarkably quiet track on which it is a real pleasure to run.

The upright supports, height 16 in., 2 ft. or 2 ft. 6 in. each, stand on a flat base size 12 in. × 8 in. direct on the ground, or packed to suit conditions, and the two ends of adjacent spans rest on each standard in slots which give rigidity. The whole, tied together by the steel rails, makes a very firm track.

Unfortunately, at the opening, the poor weather reduced the number of visitors expected, but quite a brisk service was maintained with Mr. H. D. Bond's Class "5" mixed-traffic locomotive, Mr. Hamilton's Pacific and his free-lance locomotive *Joy*. One of the Aylesbury members also ran a $3\frac{1}{2}$-in. gauge Pacific based on "L.B.S.C.'s" formula, and this also put up a fine performance.

By general request, Mr. Bond performed the opening ceremony to the clicking of cameras and the whirr of the Television Newsreel camera which recorded several aspects, included among which were close-up shots of Mr. E. W. Fraser's masterpiece, *Colne Springs*, a $3\frac{1}{2}$-in. gauge "Emmett"-type locomotive, powered by a 3-cylinder radial oscillating engine which looks like a "pawnbroker's sign gone mad."

An asbestos cement hut has been erected on site for housing spares, running equipment and fuel, and now the society is congratulating itself over the ownership of a very satisfactory layout, and not the least of their pleasure lies in the fact that all is paid for and the society, although poorer, is still solvent !



Fitting the steel rails into slots

A Four-cylinder Horizontal HOT AIR ENGINE

By A. E. Phillips

THE sight of a large horizontal gas or oil engine with its massive flywheel pounding away under load is one of those which usually leaves a lasting impression on one's mind, so, therefore, it is obvious that this is a type of engine worth copying, especially if it can be made to function in the small scale; and I personally have always been green with envy when I have admired the picture of the " Air-Oil Engine," built by B.C.J., and described in the issue of THE MODEL ENGINEER of July, 1944. Unfortunately, there are many difficulties to be overcome in building such an engine, and it was not until an article by J. W. Corbett appeared in THE MODEL Engineer of November 27th, 1952, describing a four-cylinder " V " type hot air engine, that a way out of some of the difficulties became apparent; but by using this ingenious arrangement of tandem cylinders, it was at last possible to design a four-cylinder horizontal engine which would work and still follow in general the lines of its prototype.

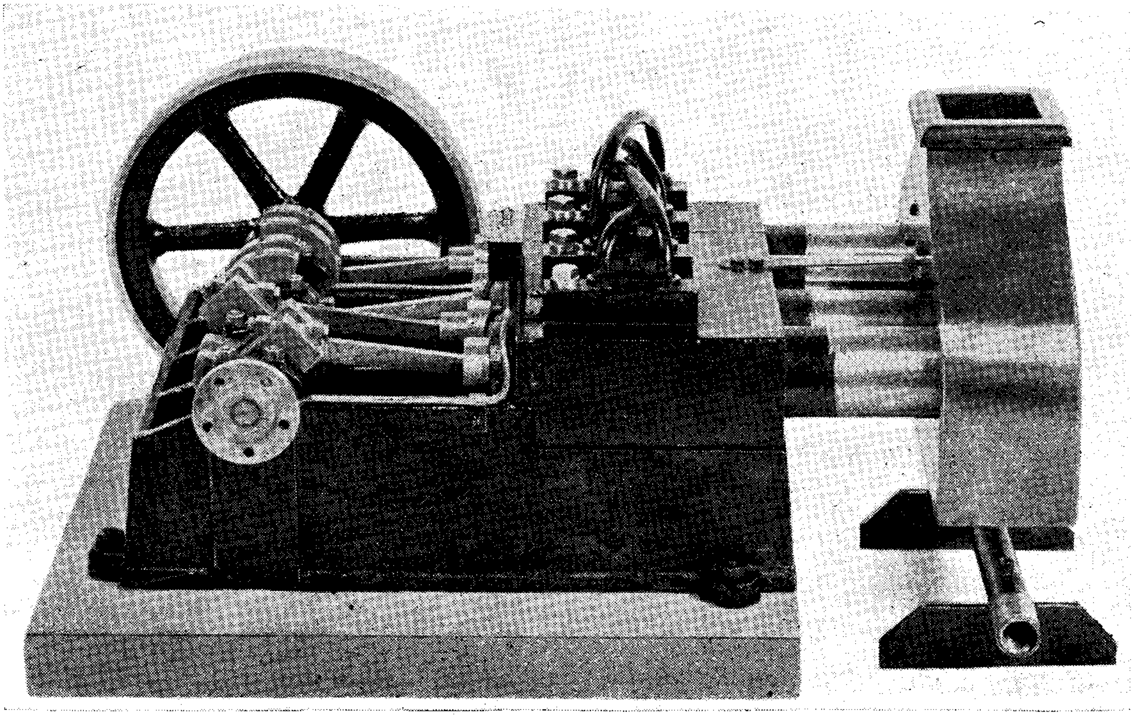
Simplicity is the keynote of this job—few working parts, some pipes, and an easily machined bedplate; the photographs and sketches should make everything quite clear, and on referring back to the article on the " V " engine, it will be seen how and why the engine works. There is, however, a slight difference in the " firing " order, due to the cylinders being in line, so that in this engine the sequence of events is as follows: No. 1 cylinder is served by No. 2 displacer, No. 2 cylinder by No. 4 displacer, No. 3 cylinder by No. 1 displacer, and No. 4 cylinder by No. 3 displacer.

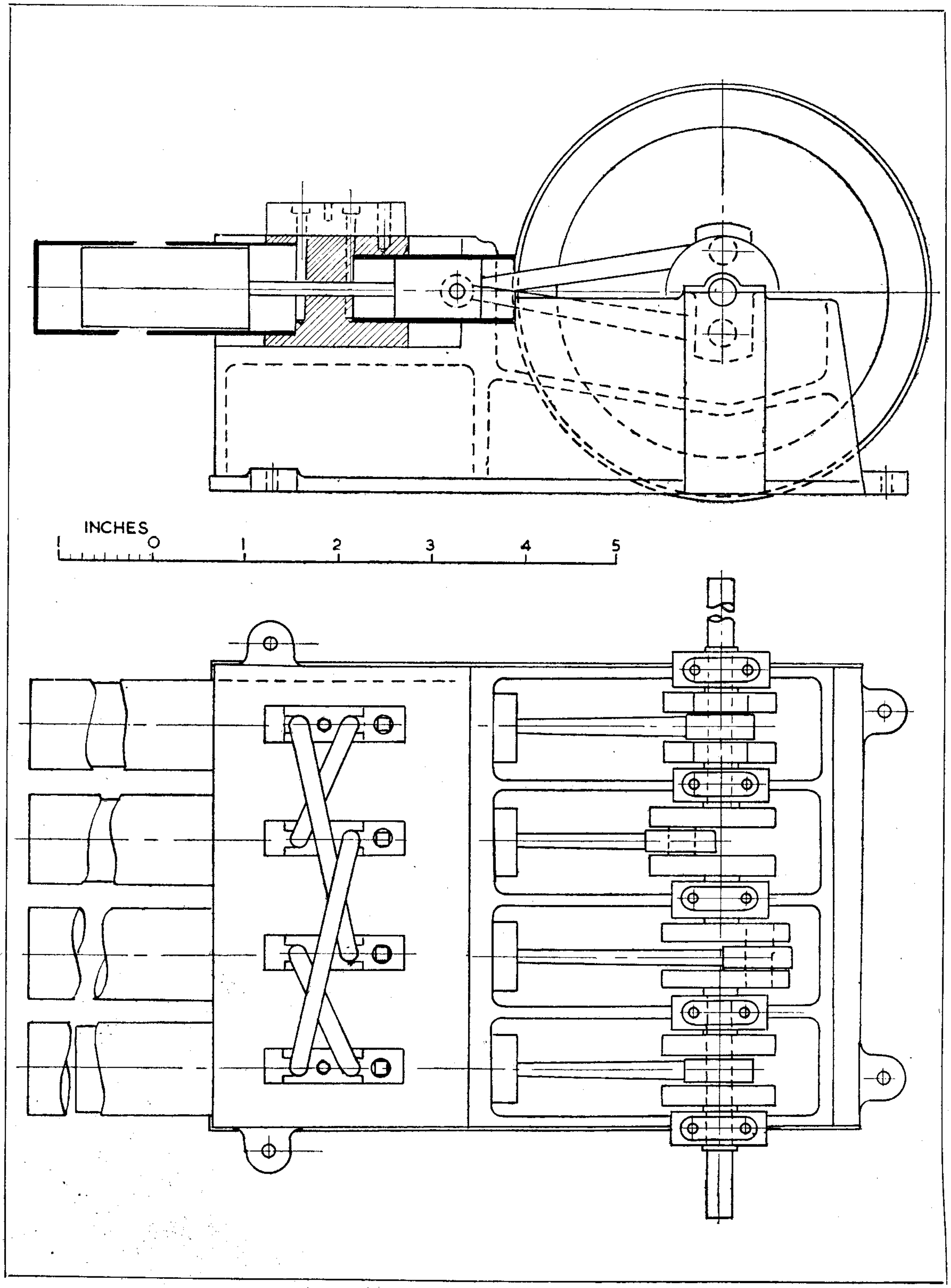
The drawings show the flywheel on the right side, its usual position, and the more conventional type of piston and round section connecting-rods, to be in keeping with standard practice. The engine as photographed was built in rather a hurry, hence its rather crude appearance. Still further improvements would be to round off some of the corners and incorporate the cylinders in the bedplate casting, but this would add to machining difficulties.

The oil-box and pipes are dummies, since an occasional drop of Redex on the moving parts is all that is needed; and, due to the mass of aluminium in the bedplate and cylinder blocks, the engine never over-heats, however long it is kept running. Only a small three-wick spirit lamp or gas burner is required, and the engine will run from a mere tick-over to round about 1,000 r.p.m.; it is dead silent when running.

The great advantage of the hot-air engine is that it can be started up instantly, and there is no messing about before or after. Further, in spite of the comments in the journal recently, I myself found immense pleasure in designing and building this engine, which shows, I hope, that this type of engine can be made to look something more than a mere toy.

The engine was on show at the Sutton Coldfield and North Birmingham Society's exhibition, and there have been many enquiries about its construction, so I hope this effort will be sufficient to satisfy those who are interested.

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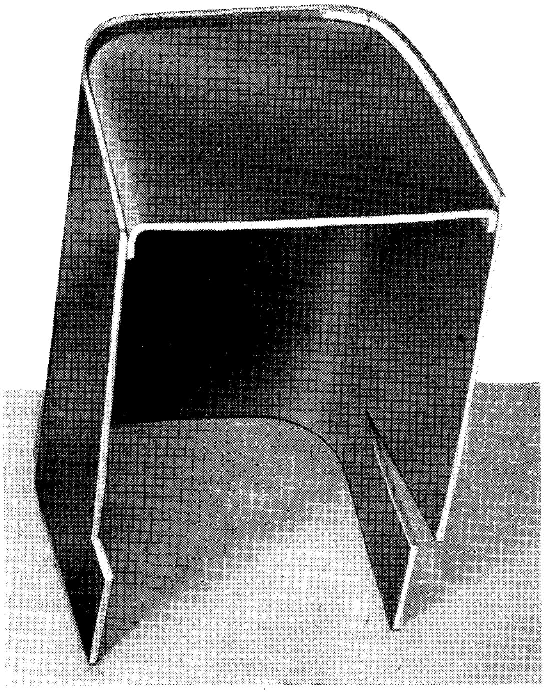
Boiler Joints

— SOME FACTS AND FIGURES

By H. E White, B.Sc.



Inner firebox back-plate in position for bronze-welding. Note: the " open " nature of the flanged joints. No rivets are necessary, the plate will be tack-welded in position

AS an active member of a number of model engineering societies, and being particularly interested in passenger-hauling locomotives, I have often noticed how many painstaking model engineers seem to specialise in building locomotive chassis ! The number of sets of castings sold by " our " advertisers seems to bear no particular relation to the number of finished locomotives running up and down—or around—our club tracks; the problem of making a boiler in scales of ¾ in. or larger seems to bring many promising pieces of work to a full stop !

If a person possesses sufficient equipment—and the skill to use it—to enable him to complete a locomotive chassis, the work of constructing a boiler should be, by comparison, a very simple matter. It is almost entirely sheet copper work, and consists mostly of cutting, hammering, and drilling holes and filling them up with screws or rivets. Why, then, is the job so often abandoned, or not even attempted ? The answer is, surely, that it is difficult to make joints which will stand up to the stresses and temperatures encountered in a locomotive-type boiler.

In the past, successful boilers were made very much in the same way as their full-size counterparts, by closely riveting the joints and caulking them to make them steam-tight, soft-solder being used to effect a seal. Of course, caulking the riveted joints in full-size practice is not done in this way, but 5-in. gauge boilers *have* been made with riveted joints, and no caulking to speak of, the tubes being expanded in, exactly as in full size. Several well-known engines have been running on exhibition and other tracks for the past twenty or thirty years with boilers made in this way, with riveted joints and soft-solder caulking, and are still working continuously and successfully. This does not mean that I, or any other up-to-date model engineer, would seriously advocate such a method of construction nowadays, except to say that if it were impossible for me to obtain the necessary equipment for brazing or welding I would not hesitate to make and use an unbrazed boiler, soundly designed and properly riveted, rather than leave the locomotive unfinished.

During the past twenty-five years or so a minor revolution has taken place in this branch of model engineering. It started with the blow-lamp brazed boiler, and has led logically to the use of the oxy-coal-gas or oxy-acetylene flame. Perhaps the blow-lamp was the original cause of this boiler-phobia; anybody who has—like myself—tried to raise the front end, back-head, or foundation ring of a 3½-in. gauge Pacific boiler to brazing temperature with a 5-pint blow-lamp knows what a fearsome job this is ! There can be no doubt that the acquiring of the necessary skill, and the collection of the equipment to tackle this job with reasonable certainty is a formidable task for the average model engineer; in many cases, it has proved too formidable. There is no doubt in the minds of many of us that oxy-acetylene has changed all this.

Many of our fraternity, however, although they are experienced and knowledgeable men, have criticised its use severely, but I have yet to hear any, but a few serious criticisms, which would bear examination. It is true that the condition of the copper sheet can be seriously affected by the fierce heat of the torch flame—indeed, with the bronze-welding technique the copper is getting very close to its melting point (within 100 deg. or so); but, provided that the flame is used skilfully, the copper should not be damaged. After all, we do not refuse to shave because the razor can be a dangerous implement ! Most of the objections arise out of the fact that those unskilled in welding techniques fail to realise that welding should not be confused with brazing—that the two methods of jointing are very different. The oxy-acetylene flame, however, is not always used only for welding; it can be used for brazing just as easily, and perhaps at this point it would be advisable to explain the difference. Strictly speaking, the word " brazing " should only be used to mean the jointing of metals by using molten *brass*. I propose, however, to use, the word to mean " hard-soldering " using any medium, such as silver-solder, which melts at red heat or above, and which penetrates the joint. In the diagram, Fig. 2, two joints are shown, one brazed and the other welded. It will be seen that the brazed joint has been made using a highly fluid medium which has run or " sweated " through the joint just as soft solder does. This involves heating the whole joint and the surrounding metal up to the melting point of the spelter, or silver-solder. The welded joint is made by *depositing* the melted welding bronze on the joint, and the main differences from the brazing method are (i) that the weld metal does not necessarily penetrate into the joint and (ii) that only *local* heating is required. It will be clear from this that a flanged joint made and fitted as in Fig. 2(*B*) is normally unsuitable for true bronze welding,

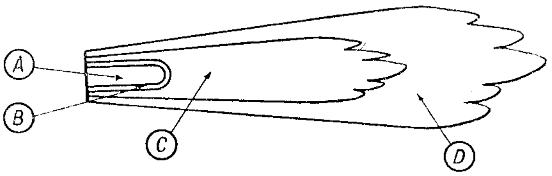


Fig. 1. The oxy-acetylene flame. A—Inner cone of unburned gas. B—Luminous inner cone. C—Reducing zone—hottest point of flame. D—Outer zone

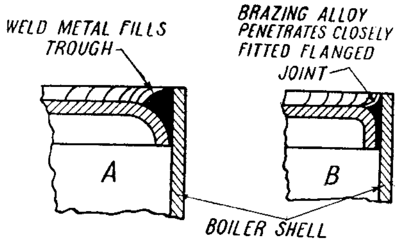


Fig. 2. Sections of flanged boiler end-plates. A—bronze-welded. B—brazed

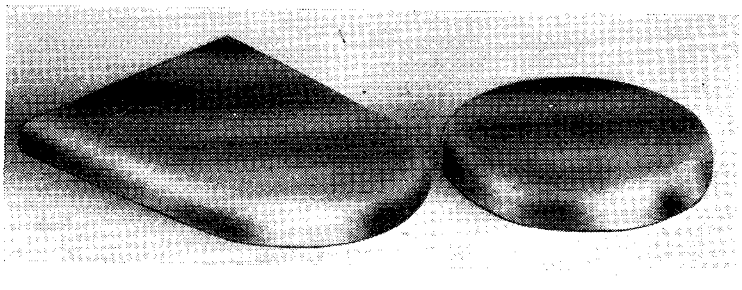
and it is, therefore, unfair to compare the two methods *when used on the same type of joint.* Joints must be designed for bronze-welding just as they must be for brazing.

It may be quite definitely stated that if the brazing is to be carried out with ordinary "spelter" or brass—that is to say, copper-zinc alloy—then the oxy-acetylene flame is unsuitable. This is because of the difficulty of avoiding the heating of the melted brazing metal to such a high temperature that the zinc which it contains will actually "boil" and be driven off as a gas, leaving the joint porous and weak. Such spelters are only suitable for the lower temperature, diffused flames of the blow-lamp or air-gas blow-pipe. The operator must understand the nature of the oxy-acetylene flame, and the diagram Fig. 1, shows that it consists of an inner region containing unburnt gas which is enclosed in a highly luminous cone. This cone is surrounded by a region in which the hottest part of the flame occurs, just in front of the luminous cone. This region is, in turn, surrounded by the outer envelope of the flame in which the heat is not so fierce. For true autogenous welding, the hottest part of the flame is used, close to the luminous cone. It is possible, however, to use the much larger and more diffused outer envelope of the flame, moving it about over a comparatively wide radius, to raise a considerable area of the work to a temperature only sufficient for a lower-melting joint medium, such as silver-solder. I have even used the oxy-acetylene flame for soft-soldered joints in tender tanks, etc. I used the extreme tip of the outer envelope of a very small flame, and applied it to the back of the joints so that the solder and the flux were not directly heated by the flame. The oxy-acetylene flame can, therefore, be used in two ways: (1) to raise a small area to a very high temperature, using the inner region of the flame, with very little movement, which is the "welding" technique, and needs a fair amount of skill and experience; (2) to heat a larger area of the work, using the outer envelope of the flame, with a greater range of movement.

The bronze-welding technique falls somewhere between these two extremes: If the flame is held too near the copper joint, there is a serious danger of burning the copper, or even of melting it. In bronze-welding only a small area of the joint (say $1\frac{1}{2}$ in. to 2 in. diameter) is raised to the melting point of the welding bronze, whereas with hard-soldering, a much larger area must be raised to the necessary temperature to allow penetration to take place. To bronze-weld a backhead joint, for instance, a medium tip would be used (say No. 13 or 18 for 10-s.w.g. copper) and the flame kept fairly close to the joint, moving it in only very small circles. I often "braze" my front end tube-plates, however, finishing both the flanged joint and the fire- and flue-tube ends at the same heating, using B6 alloy. The whole job is fluxed with a paste made by mixing No. 4a flux powder with a little water, and the boiler stood up on its backhead so that the barrel is vertical. The outer portion of a large flame (say No. 35 tip) is then played over the entire front end until it is glowing red, and the B6 strip applied, when it will flow over all the joints at the same time. This particular procedure does mean, of course, that the front tube-plate flange must fit the shell closely. If it does not, the circumferential joint should be welded first, and then, after inserting the firebox and tubes, the tube ends should be finished as described with *B*6, using the brazing technique.

The ideal joint for bronze-welding is as shown in Fig. 3. A wide trough-like formation is provided at the joint, so that the temperature of the metal may be raised to the "running" temperature of the bronze over a comparatively small area, using the hot inner portion of the flame. A special flux is used which will withstand the high temperature of the inner flame, and the molten bronze "wets" the metal just as solder does. The flame is moved in small circles and proceeds steadily along the joint as this "tinning" effect takes place. A further important feature of this welding process is that additional deposits can be laid on over the first "run," and a fillet built up in a way that is quite impossible with the more fluid brazing media.

Bronze-welding, then, can be used wherever a flanged joint is normally used, provided that the flanges are left "round." It might almost be said that whereas brazing demands well-fitted flanged joints with no gaps, bronze-welding needs badly-fitted joints ! Such joints as the backhead, foundation ring, around the edge of the front tube-plate, and firebox front and back-plates may



A backhead and smoke-box tube-plate with well rounded flanges, suitable for bronze-welding

be very conveniently and successfully bronze-welded without any danger of burning the copper, if the joints are made to suit the method—i.e., with widely-angled troughs to be filled.

Another type of joint for which bronze-welding is ideal is the butt-joint. In this case, the facility with which welding bronze can be over-

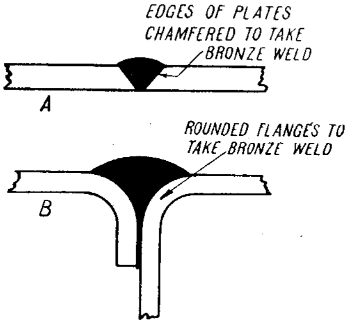


Fig. 3. *Bronze-welded joints in copper sheet. A—two plates butt welded. B—flanged joint*

laid or built up to form a fillet of any desired depth makes flanging seem unnecessary. Fig. 4 shows the difference between a butt joint brazed and a similar joint bronze-welded. By building up the fillets, the throat-plate joints in a boiler with either round-topped or Belpaire fireboxes can be bronze-welded quickly and advantageously. Furthermore, it is not even necessary to heat the copper to the high temperatures which bronze-welding demands for this kind of joint. Many interesting and useful alloys are now available for this purpose which have much lower melting points.

It cannot be too strongly emphasised, however, that in the case of a boiler which has been designed with joints suitable for brazing, with full penetration of the brazing medium, *bronze-welding is not suitable.* This does not mean that brass spelter and a blow-lamp must be used, in fact the silver alloys and the oxy-acetylene flame are better from the manipulative point of view, and the joints will be equally strong.

At this point we had better examine this question of brazing and welding alloys. I have recently interviewed the makers of the most important of them with a view to finding out which alloys are most suitable for our purposes, and which are specially recommended for specific jobs. It is, of course, assumed that, as proprietary welding or brazing alloys, they are capable of forming a firm joint, with or without fluxing as the case may be, when used with copper and allied metals, and, therefore, the characteristics of these alloys which interest us, are: (i) the melting points, and the temperature range of these melting points in certain cases; (ii) the tensile strength of the metal at the joint; and (iii) the structural nature of the metal as indicated by its elongation factor. This figure represents the amount of stretching which takes place when a length of the weld metal is subjected to a tensile strain until it breaks, expressed as a percentage of its original length. It will be obvious that a highly ductile or malleable metal will normally stretch to a much greater extent under such stresses than a brittle alloy which will resist the stress with comparatively little movement until it breaks sharply. In general, the latter type of alloy will be unsuitable for joints in a copper boiler, which are liable to " movement " as the soft copper flexes under varying conditions of temperature and pressure.

The particulars below, in table form, have been taken from details published by the suppliers of the alloys concerned:—

In the first place, it is evident that Sifbronze and Brazotectic, which are both strongly recommended by the makers for our kind of work, have very similar characteristics. Their melting points are some 200 deg. C. lower than that of copper, and their tensile strengths are about double that of copper, which, coupled with their high ductility factor indicates that a bronze-welded butt-joint in which the thickness of the weld metal is equal to that of the parent metal is much stronger than the rest of the copper sheet. The other "tectic" listed, i.e. Cuprotectic, whilst having an attractively low melting point, has a low tensile strength, and an extremely low elongation figure (one half of one per cent.) which indicates that it is of a very brittle nature, and, therefore, its use might lead to failure of the boiler structure, in certain circumstances. It is also apt to fail under varying temperature conditions, but this alloy will be referred to later.

Now for the silver alloys. It will be noticed that two melting-point figures are quoted in some cases. These represent the points at which the alloy first begins to melt partially, and that at which the whole of the metal is in a liquid state. These alloys are said to have a " plastic range " which is an extremely valuable property from the torch welder's point of view. On the

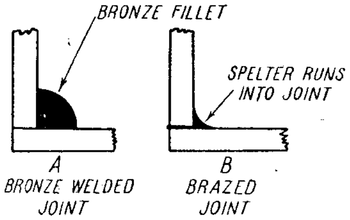


Fig. 4. *Angle butt joints in copper sheet*

other hand, one of the silver alloys—our old friend Easy-flo—has a very narrow plastic range (620-630), which means that it becomes totally fluid very rapidly, and accounts for the characteristic way in which this alloy " flashes " round a joint as soon as the correct temperature is reached. Such highly fluid alloys, when melted, are only suitable for closely fitted joints; they will not " build up " or fill wide gaps, owing to the low surface tension of the fluid melt.

(*To be concluded*)

Alloy	Makers	Melting Point °C.	Approx. Tensile Strength tons/s.i.	Elongation %	Flux
Sifbronze No. 1	Suffolk Iron Foundries Ltd.	850	28	28	Sifbronze
Brazotectic (Sifbronze)	B.O.C.	875	29.1	22	Brazotectic
Cuprotectic	,,	705	10.7	0.5	None
Silbralloy	Johnson Matthey & Co. Ltd.	638-694	35	5	None
Argo-flo	,,	605-651	32	20	Easy-flo
Easy-flo	,,	620	30	35	,,
Sil-fos	,,	625-780	45	10	None
B 6	,,	790-830	28	—	Tenacity, 4a
Copper	—	1,083	14.7	—	—

READERS' LETTERS

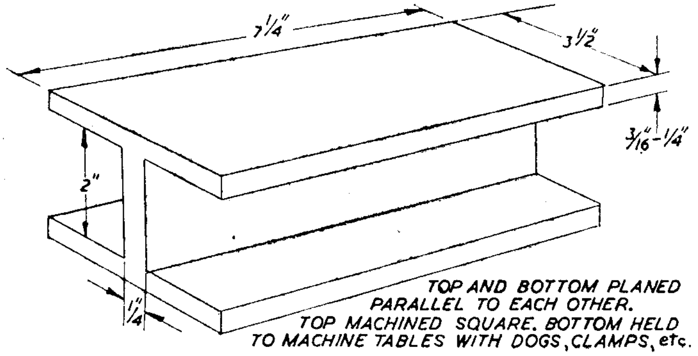
● Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

A SHAPER ATTACHMENT

DEAR SIR,—The following idea is probably as old as the hills, but it is new to me, and it works well. It is possible, therefore, that it may be of interest to your readers.

The rough sketch is self-explanatory as regards construction, and the dimensions may be varied at will. The material used is, of course, mild-steel.

The purpose of this astonishingly intricate gadget is for attaching to the table of a shaper or possibly the faceplate of a lathe or any machine with a slotted table, so that flats and sheet (plastics for example), may be easily held and worked, the material being held to the table either by clamps or set-screws or any other normal method. Needless to say, the size of the work to be machined is governed by the capacity of the machine.



Yours faithfully,
Liverpool. T. V. ANTHONY.

MODEL ENGINEERS AND PUBLIC PRIVILEGES

DEAR SIR,—Your recent paragraph in "Smoke Rings" relating to the banning of power boats and cars in public parks prompts me to suggest that there are certain methods which an active club might adopt with a reasonable chance of getting its privileges restored. I agree with your comment that the ban is often the result of no more than one or two complaints which the club is given no opportunity to answer. In such a case, the club should itself adopt the "noisy minority" tactics and make a far bigger fuss about the effect of the ban than that which caused its imposition. This is how to go about it; first of all it must be realised that the one thing which will make councillors sit up and take notice is loss of personal votes. The first step, therefore, is to find out which members of the council are due for re-election next May, and have a club member call on each one and explain the club's point of view. It is helpful if the club member lives in the ward which the councillor represents in each case. Get all the members and their friends to make sure that the canvassers hear about it when they start calling. Write a letter to the Town Clerk asking the council to reconsider the matter and putting the club's view. Get it signed by the president rather than by the secretary. If the council is a County Borough, see the Director of Education and the Chairman of the Education Committee, and play up the educational angle; don't try this in the case of a non-County Borough or Urban District Council, because in these cases the education authority will be the CountyCouncil, and the Local Council will probably resent any interference from them. Write to the president of the local Rotary Club, put the difficulties before him, play up the "harmless and instructive hobby" angle and ask if his club can do anything to assist. Probably several councillors will be Rotarians.

In short, make it clear that the ban is causing the club great difficulty and that you all feel very strongly about it. Be prepared for a prolonged campaign if need be. Stalling for time in the hope that the heat will die down is a common ruse in local affairs. This is, of course, a minor form of pressure politics. I don't like it, but know from personal experience that it often works.

Yours faithfully,
Llandrindod Wells. SIMPLE SOUL

GRADUATED FACEPLATES

DEAR SIR,—IT is not every make of lathe faceplate which is graduated or "ringed" on the face. This seems a little surprising, as the cost of such an addition must indeed be trivial, can be carried out in a few minutes, and is well worth the trouble. Not only is the appearance enhanced, but there is clearly a gain in efficiency in the setting up of work on the faceplate, as the lines at once give an indication of position, and in the case of turning a curvature on separate parts bolted in series to the faceplate, it is wellnigh indispensable.

It is a simple matter to cut the graduations required on a faceplate, as it is only necessary to determine a method of cutting them an equal distance apart throughout.

Spacing of about $\frac{1}{4}$ in. is correct, which gives increments of $\frac{1}{2}$ in. in measuring the work diametrically.

As most lathes have 10-t.p.i. feed screws to the cross-slide, it only requires two and a half turns of the latter between each cut, and if the lathe is fitted with an index plate, accuracy is assured.

The lathe should be run dead slow when cutting the graduations, the depth of which need be no more than 0.015 or 0.020 in. at most, using if possible a keen-pointed carbide tipped tool.

When finishing the "M.E." drilling machine, I cut these graduations on the drilling table, as it was considered to be an asset in setting up work accurately, the intention being that the table itself would revolve by means of a worm and gear movement for the purpose of light milling work.

Yours faithfully,
Glasgow. R.J.

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

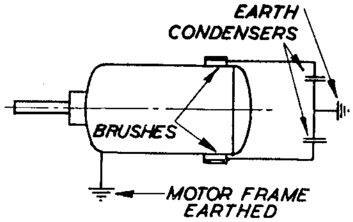
(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Suppressor for Electric Motor

Could you please tell me how to stop the noise in neighbours' wireless sets, caused by mv $\frac{1}{4}$-h.p. General Electric motor, single-phase, 230 V, 60-cycles; it has two round carbon brushes. Can I cure the trouble by putting condensers across the brushes, and if so, can you tell me what type to buy. Your advice would be greatly appreciated.

B.B. (Liverpool).

In reply to your query, the usual type of suppressor fitted to electric motors consists of either two condensers in series or a special centre-tapped condenser, the outer connections of which are taken to the brushes of the motor, and the central connection to earth.



As you are using a $\frac{1}{4}$-h.p. commutator type motor, the interference will probably be considerable, and it may happen that the simpler types of suppressors are found inadequate, but special suppressor units can be obtained from Messrs. A. F. Bulgin Ltd., Alfred's Way, Barking, Essex. If you inform them the size and type of motor to which the suppressor is to be fitted, they can supply a suitable type.

Model Car Designs

I am very interested in building a model racing car; I hear that your publishing department can supply plans for these jobs, and I wondered if you could advise me of a fairly easy model to start with.

The engine I have at the moment is an E.D. "Bee" 1 c.c. Could you possibly tell me what sort of reduction gear would be necessary for the actual drive, or could it be run straight off the motor without being geared down?

A.C.L. (Upper Barnhorne).

We suggest that our design of a 158 Alfa-Romeo would be suitable for your purpose. The fully detailed design for this car is obtainable from our Publishing Department, in three sheets, price 7s. 6d. per set.

With reference to the transmission for a car of this type, in some cases, the wheels are driven direct, that is to say at engine shaft speed, but it is desirable to fit a centrifugal clutch so that the engine can take up the drive gradually. In other cases spur or bevel gears are employed. The most common ratio of reduction is about 2 : 1.

Watch Threads

I would like to know whether there is a recognised standard for watch threads or if the screws vary according to the country of origin.

Could you tell me also how the watchmaker's screwplate is classified, and to what standard the screw threads are cut?

F.B. (Brierley Hill).

There are several recognised standards for watch threads, including Bourgeaux and Latard, the former having 26 numbers ranging from 00 to 24, and the latter 21 numbers from 0 to 20, covering a range from approximately 2.25 mm. down to 0.3 mm.

The most popular makers of Swiss screw plates are Perrelet Martin or Martin Fils, and plates by these makers are marked "B" for Bourgeaux and "L" for Latard. Plates marked "S" have very fine threads intended for Swiss barrel arbors. Left-hand thread plates are marked "G."

The most modern screw thread is the Progress thread, which is made in a range of sizes, the diameters of screws being indicated by numbers, in increments of 1/10 mm. Thus the number 10 would represent 1 mm., number 14=1.4 mm., etc. Of the three thread standards, the Latard is the finest in pitch and the Progress the coarsest.

Milling Attachment

Can you please inform me if the Abwood Milling attachment is still made, and if so let me have their address?

D.H. (Lytham).

We do not think that the Abwood Milling attachment is at present manufactured, but the makers, The Abwood Tool and Engineering Co. Ltd., Prices Road, Dartford, Kent are still in business, and it might be worth while enquiring whether they can still supply it.

Repairs to Accumulator Casing

I have a 6-volt car battery, the outer container of which has developed a small hair line crack one to two inches long, from the top edge which is allowing the acid to leak.

Can this be repaired? If so, what should I use for a sealer, and where can I obtain it?

J.D. (Tottenham, N.17).

The material usually employed for these casings is a rubber composition similar to ebonite.

In some cases a satisfactory repair has been made by enlarging the outside of the crack to a V-groove, and after thoroughly cleaning and drying the casing, to run in an acid-resisting cement such as Chatterton's Compound.

The success of a repair of this nature will depend on getting thoroughly good adhesion between the cement and material of the casing, and this depends on thorough cleaning, and using a sufficiently high, but not excessive, temperature for running in the cement.

Indexing Gear Wheels

Could you advise me how to make a wheel with 116 teeth, using a Quick-Set dividing head? I have three plates, each with 3 rows of holes, as follows:—

36	51	34
38	43	30
39	42	27

A.P. (Liverpool, 6).

This will require the use of a division plate having a multiple of 29 holes, and, therefore, none of the plates specified will give the required number of divisions.

In the case of a worm dividing head, such as you possess, however, it would be possible to get fairly accurate results by making up a temporary plate with 29 holes spaced as equally as possible by measuring up with dividers.

The errors in spacing of the holes would be sub-divided by an amount equal to the ratio of the worm gear reduction, and the results will, therefore, be sufficiently accurate for general purposes.